PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

PMM

DESIGN • MANUFACTURE • FINISHING • USE

These MONARCH-MEN

are ready to serve you...NOW!

These carefully selected Monarch-Men are located in the heart of industry's busiest areas.

They offer expert analysis...production experience and practical assistance should any trouble develop.

They are exclusively Monarch-employed, trained in aluminum permanent mold, aluminum and zinc die casting production methods.

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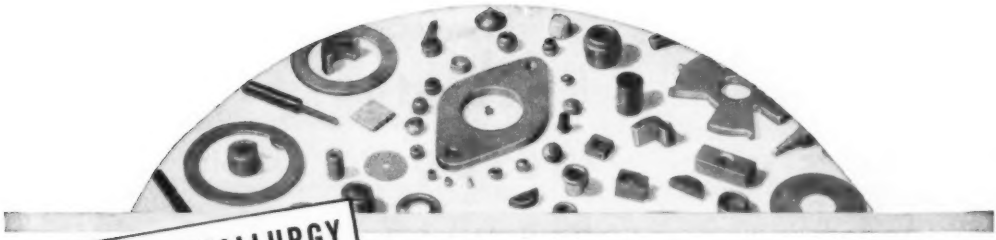

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THE MACHINES UNIVERSALLY USED

POWDER METALLURGY is the process being chosen for the manufacture of many products because of the cost savings produced from this automatic, high speed production method. Parts such as porous, self-lubricating bearings, carbon brushes, and insulators, Alnico magnets, carbide tool bits, magnetic radio cores, contact buttons, gears, cams and literally thousands of other items are accurately and automatically made with unbelievable cost savings on Kux Presses.

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JANUARY 1952
Vol. 10 No. 1

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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Acceptance under Section 34.64 P. L. & R. authorized at St. Joseph, Mich.

DIE CASTINGS for Defense!

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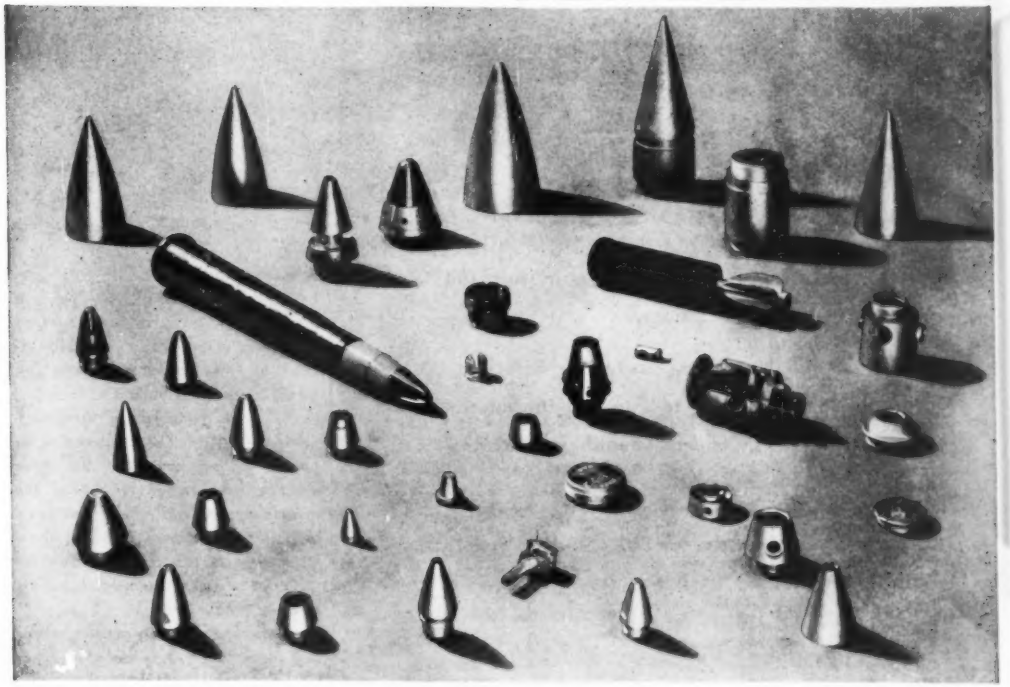
We can offer you experience and production know-how in producing hundreds of different items essential to defense.

During World War II, Precision Castings Co. emerged as a leader in the die casting industry in producing military, naval and aircraft items.



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*Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry

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• Need die castings? Newton-New Haven has the facilities for the production of zinc and aluminum alloy die castings.
Place your die casting responsibilities with Newton-New Haven. Here is an organization that has the equipment, the personnel, the experience and the whole-hearted desire to help.
Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is a basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.
NEWTON NEW HAVEN
THE NEWTON-NEW HAVEN COMPANY
689 THIRD AVENUE
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CONNECTICUT
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LETTERS TO THE EDITOR

REVISED MAGAZINE

I have recently received my first copy of "Precision Metal Molding." I would like to congratulate you on, not only the appearance of this revised magazine but more especially in your wise decision to include powdered metals and other types of metal moldings.

In the past I would only glance through your former magazine, "Die Castings Magazine", but I now find myself reading your renamed publication from cover to cover.—W.T.S.

DATA ON POWDER METALLURGY

We are in receipt of the September issue of your magazine and would like to say how much we appreciate the improvements you have made.

We would like to have any published technical information which is available on Powder Metallurgy, or reproductions of any published articles on this subject which you can give us.—E.S. (England)

We have received so many requests for sources of information on powder metallurgy that we have mimeographed a short list of the principle books and bibliographies on this subject. A group of comprehensive works in this field covering the technical aspects of powder metallurgy have been listed.

It was the need for a regular source of information on this and other types of precision metal moldings which led to the expansion of the editorial coverage of Die Castings magazine under our new name, Precision Metal Molding.—Ed.

FRANGIBLE CORES FOR DIE CASTING?

I should be greatly obliged if you could direct me to any published information on the use of frangible or soluble cores for die-casting which

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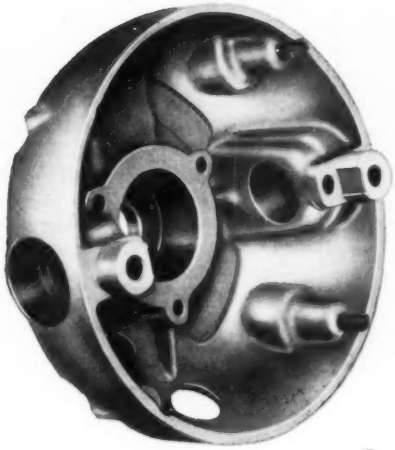
DESIGNING TO ADVANTAGE
WITH
MADISON-KIPP

Zinc and Aluminum Die Castings



Greater emphasis than ever before must now be given to weight saving and labor saving in the production of metal parts.

No process, we believe, gives a product designer so many advantages as pressure die casting. The illustrations in this advertisement show weight reducing coring and multiple holes and bosses in a die cast end cover for a motor housing. Please send all inquiries to our home office in Madison, Wisconsin.

MADISON-KIPP CORPORATION

213 WAUBESA STREET, MADISON 10, WIS., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
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- *Originators of Really High Speed* AIR TOOLS

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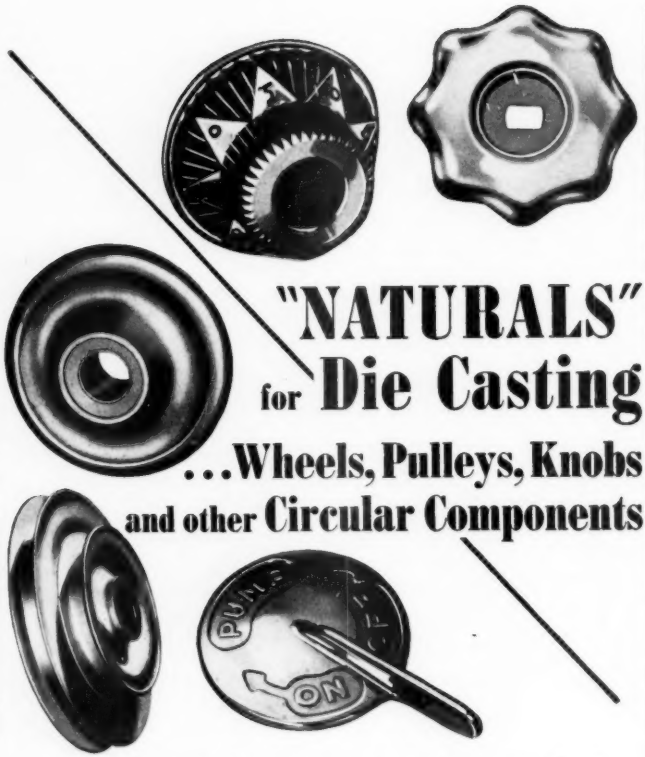

"NATURALS" for Die Casting ...Wheels, Pulleys, Knobs and other Circular Components

Flywheels, handwheels, pulleys, discs, control knobs, circular dials and covers are typical of circular units often die cast in quantity with substantial savings to the user.

Such savings are reflected in (a) the actual production cost of the finished part, (b) machining and finishing operations eliminated, (c) assembly time saved.

Other inherent advantages may include:

- **Cast-in sleeves or bushings, holes, slots, grooves, or undercuts.**
- **Cast-in lettering, numerals, gradation marks.**
- **A high degree of concentricity and balance.**
- **Elimination of excess weight.**
- **Faithful mass duplication of the original design.**
- **Improved sales appeal.**

The next time you have the problem of producing circular components accurately, and in quantity, consider having them die cast by MILWAUKEE.

MILWAUKEE DIE CASTING COMPANY
1019 N. FOURTH STREET • MILWAUKEE 3, WISCONSIN

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LETTERS TO THE EDITOR
continued from page 4

would permit coring which, due to its geometry, would be impossible or difficult by the conventional withdrawable metal cores. It is, of course, well-known practice in sand casting of iron or steel to make cores of sand, usually held together with a binder, which are removed from the cold casting by crushing or picking out the core sand. I understand that the same technique is applicable to die-casting of, say, a zinc base alloy by using a die of conventional hobbed or milled steel for which core inserts of a material such as plaster of Paris or an organic plastic material have been precision cast or molded in quantities, one of which is laid in the metal die as a core insert for each casting and, subsequently, either tumbled out in the case of plaster of Paris or dissolved out in the case of an organic plastic.

I will be particularly interested in any information on materials used for core inserts and methods of molding them. — H.H.

It is not commercially practical to use any sort of frangible or soluble core in die casting in order to form undercuts or cavities which cannot be withdrawn by straight core pull. The source of your information, however, may be using the British terminology of "die casting" to indicate the gravity *die casting process, as compared to* pressure *die casting. In the United States this gravity process is called "permanent mold casting" and it is common practice to use frangible cores in conjunction with steel molds in this latter process.*

Baked sand cores for this purpose are made in the identical fashion as is practiced for forming sand casting cores, and are held in the steel mold by means of small metal core pins which position them until the casting is ejected. The use of sand cores is

continued on page 57

OFFERED IN THIS MONTH'S ADS

NOTE: Circle numbers on the enclosed postcard to indicate literature, samples or trial services you wish to receive.

No. 2. THE FACILITIES OFFERED by the Admiral Die Casting Corp., are described in a bulletin offered by the company.

No. 4. "WE'RE GEARED FOR YOUR DEFENSE NEEDS" explains the facilities of the Advance Tool and Die Casting Co.

No. 5. SCRAP RECOVERY, a reprint of an article, is offered by the Ajax Engineering Co.

No. 10. "QUALITY PRECISION CASTINGS", a booklet describing their die castings and facilities is available from the Atlantic Die Casting Co.

No. 12. METAL OF THE MONTH letter summarizing market data can be secured from Belmont Smelting & Refining Works, Inc.

No. 20. HOW SMALL CAN DIE CASTINGS GET is told in literature available from the Gries Reproducer Co.

No. 22. DESIGNING FOR POWDER METALLURGY is described in an engineers handbook issued by International Powder Metallurgy Co.

No. 23. FOR ENGINEERING ASSISTANCE AND ADVICE on aluminum and aluminum alloys write the Kaiser Aluminum Co.

No. 24. PRESSES FOR POWDER METALLURGY are described in a booklet issued by the Kux Machine Co.

No. 25. DESIGNING FOR DIE CASTING is some of the information contained in a booklet issued by Litemetal Dicast, Inc.

No. 27. FILTERS FOR LIQUID LINES are described in a catalog offered by Marvel Engineering Co.

No. 29. ELIMINATE LEAKY CASTINGS by Mogulizing. The process is described by the Metallizing Co. of America.

No. 30. ADVICE ON THE SELECTION OF METAL POWDERS can be secured from the Metals Disintegrating Co.

continued on page 8

FOR Westinghouse!

Westinghouse Electric Corp. recently required a part for use on oil circuit breakers. Their rough blueprint called for a link composed of three separate units which had not only to be machined, but welded together.

Atlantic's engineers suggested a design that resulted in a part cast in ONE PIECE from Atlantalloy #31 High Tensile Manganese Bronze . . . a dependable engineering material that is stronger than many steels. This one piece casting eliminated the involved machining, welding and finishing steps—and consequently afforded a substantial saving over former costs.

Write for a copy of "Quality Precision Castings for Industry" today. This booklet shows how the plaster mold process cuts production costs and includes specifications on Atlantic's alloys.

ATLANTIC CASTING and ENGINEERING CORP.
Established 1937
721 Bloomfield Avenue • Clifton, N. J. • PRescott 9-2450

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BETTER METHODS
SUPER CAST
DIE CASTINGS
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SINCE 1919

The meaning of a signature!

Through a quarter of a century of knowing how, the SUPER CAST reputation for Better Methods—Better Die Castings, has been recognized.

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SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

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THE SUPERIOR DIE CASTING COMPANY

1001 London Road CLEVELAND 10, OHIO

Detroit Chicago Pittsburgh
Philadelphia New York

For additional information circle No. 50 on the Reader Service Card

continued from page 7

No. 31. DIE CASTING MACHINES featuring ease of operation and ultra safe rugged construction are described by the Miller-Taylor Tool Co.

No. 32. FOR METAL MELTING EQUIPMENT information is available from the C. H. Milles Foundry Co.

No. 34. FACT FILE is a new booklet offered by Monarch Aluminum Co. which describes their facilities and services.

No. 37. DIMENSIONING DIE CASTINGS is vital information for every engineer who uses or contemplates using die castings. Copies are available from the Newton-New Haven Co.

No. 52. THE FACILITIES AND SERVICES of Tri-State Die Casting Corp. are described and illustrated in a free catalog.

No. 53. AN ALUMINUM ALLOY SELECTOR is offered by the U. S. Reduction Co.

No. 58. THE CERTIFIED ZINC ALLOY PROGRAM is described by the American Die Casting Institute.

No. 60. AN AUTOMATIC SHOT CONTROL UNIT is fully described in a catalog available from the Ring Valve Co.

No. 61. VARI-SHAPED BURNISHING BALLS and their uses are described in a catalog available from the Abbott Ball Co.

No. 62 MACHINES FOR ENAMEL FILLING on die castings are listed and described in a catalog from the Acromark Co.

No. 63. ADVANCED BARREL FINISHING is the title of a 22 page booklet available from Almco Div. of Queen City Stove Co.

No. 64. HOW TO STORE COATED ABRASIVES is told in a booklet issued by Armour & Co.

No. 66. SPRAY PAINTING MASKS AND RELATED EQUIPMENT is described in a catalog available from the Conforming Matrix Corp.

No. 67. AIR POWERED EQUIPMENT FOR REDUCING FINISHING COSTS is described in a catalog available from the Dumore Co.

continued on page 59

USCO

USCO K Aluminum Alloy (3.5 Cu and 8.5% Si) together with the entire USCO K series are tailor-made for die-castings. Each alloy in this K series meets a specific die casting requirement for a particular purpose. These alloys are produced to exact specifications . . . either ours or yours . . . under our famous Production Control System—a guarantee of consistent high quality. USCO K or one of the other die casting alloys in the K series will meet your requirements of excellent castability and dependable finished castings. Won't you determine this for yourself, in 1952, by joining our ever growing list of satisfied customers?

FREE Send for your copy of the USCO Aluminum Alloy Selector. A handy aid to analysis, specifications and many other foundry problems.

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PLANTS: EAST CHICAGO, INDIANA • TOLEDO, OHIO

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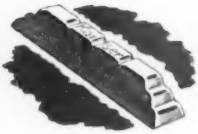
Engineering Assistance and technical

advice on any aluminum casting

or extrusion problem is yours for the

asking to help you make better use of

Kaiser Aluminum pig, specification

ingot  or extrusion billets

▶ Aluminum pig, specification ingot, extrusion billets. Sales offices in principal cities. Kaiser Aluminum & Chemical Sales, Inc., Oakland, California.

Kaiser Aluminum

A major producer of aluminum pig, specification ingot and extrusion billets

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PRECISION,

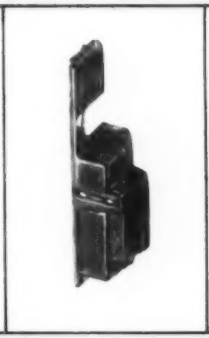
PLUS

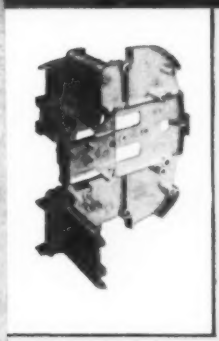
Precision in die castings is easily measured. Not so easy to calculate is the *extra* care that goes into castings produced by ADVANCE PRESSURE CASTINGS.

From blueprint stage on, expert engineers, skilled metallurgists and careful craftsmen take full advantage of their know-how, our custom tooling and complete-under-one-roof production facilities to give you a product superior in every respect.

By being far more demanding than our customers, we have been able to maintain the quality that has built a small shop into one of the largest and best equipped plants in the East.

We will gladly discuss any casting problem you may have, without obligation.





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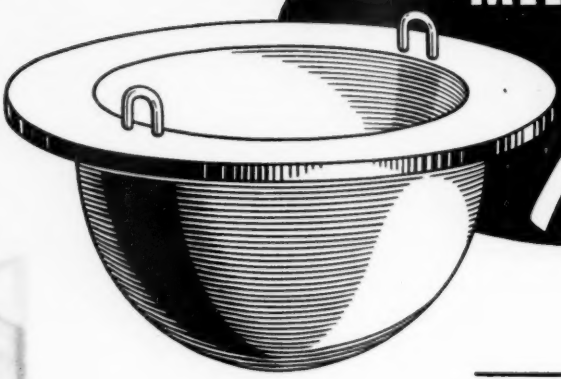

COMPLETE LINE OF MELTING EQUIPMENT FOR DIE CASTERS, NON-FERROUS FOUNDRIES, AND SMELTERS

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Get Catalog No. 101 for detailed information on our complete line of melting equipment.

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15 ARDMORE ROAD • SCARSDALE, NEW YORK
TELEPHONE 3-6669

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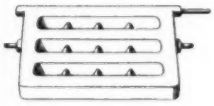

4. WATER COOLED MOLDS

2. PRESSED STEEL LADLES

5. IRON MOLDS FOR ALL NON-FERROUS METALS

3. CAST IRON POURING LADLE

6. THERMOCOUPLE PROTECTING TUBES. STANDARD TUBES ARE 1⅜" O.D. THREADED FOR ¾" PIPE. STANDARD LENGTHS RUN FROM 12" TO 48"

C. H. MILLES FOUNDRY COMPANY

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DIE CASTING
carries the load better
...and at less cost

CASE HISTORIES FROM MT. VERNON FILES

Each time a new product is slated for production, there arises the weighty question of what manufacturing procedure will prove most advantageous. That's when die casting merits careful consideration. For the outstanding efficiency and economy inherent in the die casting process means *quality at minimum cost.*

Here's a case in point: The new Lewyt Model 55 vacuum cleaner. Not only are its attachments die cast, but also the revolutionary new "caddie" which carries them. On the top of the caddie, are holders for four cleaning tools; on the bottom, holes for assembling the caddie to the dolly, and a clean-cut lip around the periphery to insure perfect contour fit. All these details are produced simultaneously, as the die closes — producing a light, strong unit which typifies the time-saving, step-saving and money-saving properties of die casting.

If you use metal parts in appreciable quantities, it's a safe bet die casting will "take a load off your mind" by helping you make a clean sweep of production problems. So why not follow the example of Lewyt, and consult with us? We feel confident we can show you the way to lower unit costs, improved products, increased output.

The Lewyt Model 55 was awarded the 1950 Merit Award of the American Society of Industrial Engineers, and termed "the best vacuum cleaner produced anywhere in beauty, engineering design and utility."

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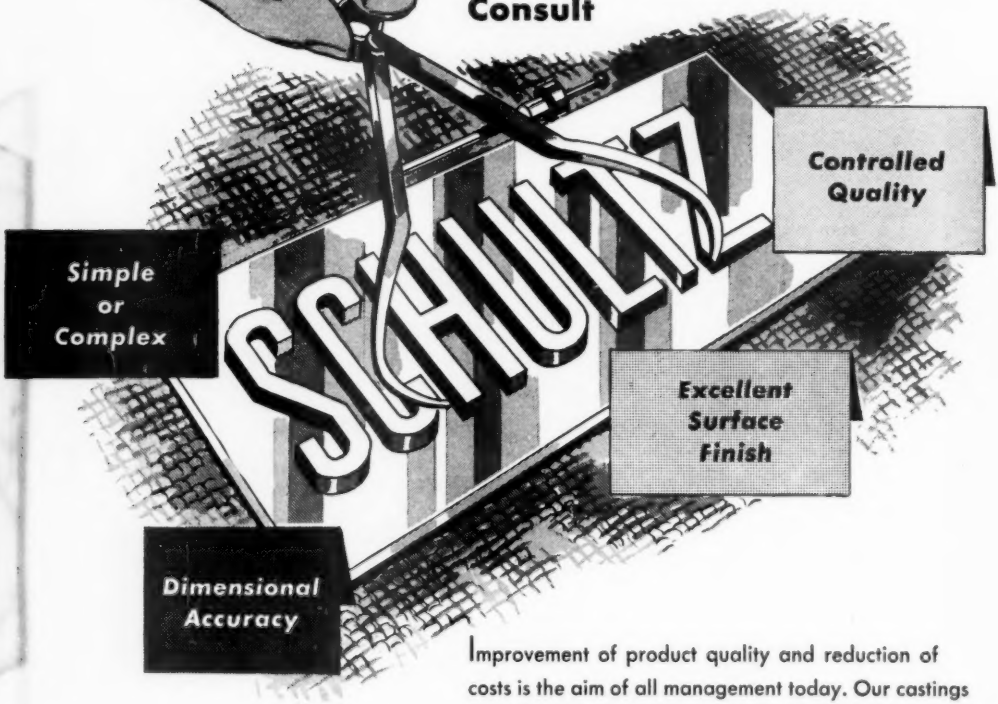
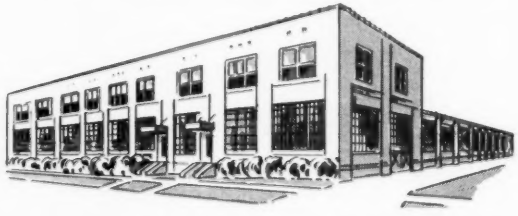
For Zinc Alloy Die Castings That Measure Up To The Highest Standards Consult



Improvement of product quality and reduction of costs is the aim of all management today. Our castings are both competitively priced and outstanding in quality, and can help you build a better product for less. May we quote on your requirements today?

Our Engineers Are At Your Service



SCHULTZ DIE CASTING COMPANY
1810 CLINTON STREET • TOLEDO 7, OHIO

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Look for this SEAL
When Buying
ZINC DIE CASTINGS

Buy with Confidence from these Companies who subscribe to the CERTIFIED ZINC ALLOY PLAN...

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The Accurate Die Casting Co., Cleveland, Ohio
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Advance Tool & Die Casting Co., Milwaukee, Wis.

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Dunkley-Jarvis Corp., Toledo, Ohio
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Globe Imperial Corporation, Rockford, Ill.
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Hollander Corporation, Toledo, Ohio
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Kamin Die Casting & Mfg. Co., Chicago, Ill.
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Racine Die Casting Co., Racine, Wis.

St. Louis Die Casting Corp., St. Louis, Mo.
Schultz Die Casting Co., Toledo, Ohio
Sterling Die Casting Co., Inc., Brooklyn, N. Y.
Stewart Die Casting Div., of Stewart Warner Corp., Bridgeport, Conn.
Stewart Die Casting Division of Stewart Warner Corp., Chicago, Ill.
Stroh Die Moulded Casting Co., Milwaukee, Wis.
Superior Die Casting Co., The, Cleveland, O.

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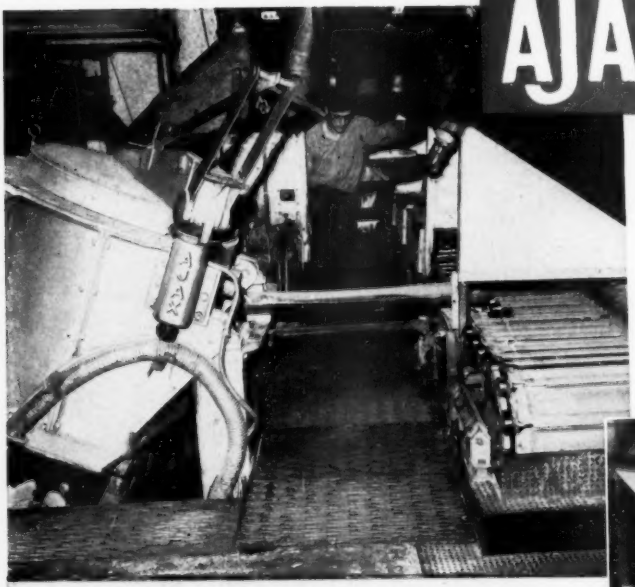
MILLIONS of POUNDS

of Aluminum per year reclaimed with the help of

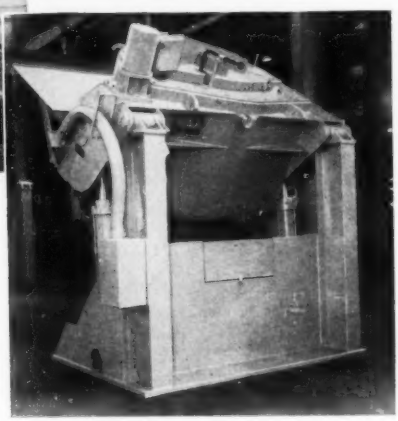
AJAX INDUCTION FURNACES



155 kw AJAX Induction Furnace in tilted position, pouring molten aluminum alloy through a coated trough into ingot molds on conveyor.

MAJOR AUTO MANUFACTURER RECOVERS SCRAP FROM MACHINING OPERATION BY MODERN MELTING PROCESS

Here is an interesting setup for reclaiming aluminum alloy chips, which is installed adjacent to the piston casting setup in one of the largest automobile manufacturing plants in the country. More than half of the aluminum needed for pistons in this plant comes from this scrap recovery program. A considerable net profit is realized, and aluminum purchases are lowered.



Above is a 330 kw furnace. AJAX Engineering Corporation manufactures low frequency electric induction furnaces in a great variety of sizes ranging from 20 to 1000 kw. This type of equipment has been adapted to the full range of non-ferrous metals and alloys.

Send for Reprint of Article on Scrap Recovery by Induction Furnaces

AJAX

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INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
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LIGHT METALS DIVISION

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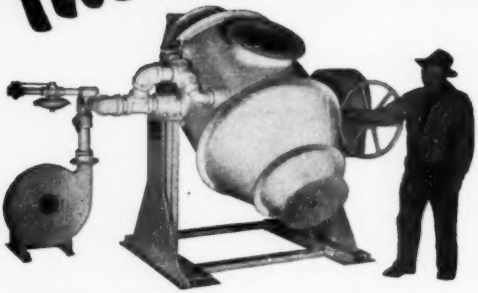
The Foremost Furnaces

for Melting any type of Non-Ferrous Metals in Foundries, Die Casting and Permanent Mold Plants



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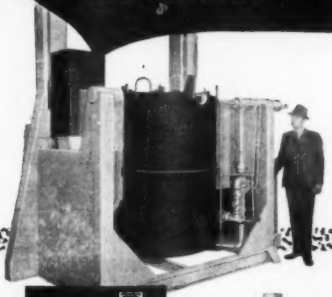
Featuring "Tangential Firing" which produces a most efficient combustion condition, creating a melting atmosphere that keeps metal loss and dross accumulation at a minimum. Charges through the top or rear door which is also used for drossing metal and cleaning the furnace. Built in 500 lb. capacity and larger. Oil or gas fire.

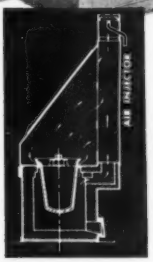


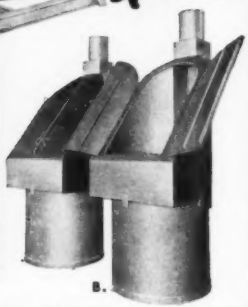
A.

STROMAN MAGNESIUM AND ALUMINUM MELTING AND HOLDING FURNACES

A. Hydraulic Tilt Magnesium and Aluminum melting furnace handling from 500 to 3000 lbs. of aluminum. Incorporates the famous Stroman Stationary Lip Pour, which creates a constant pouring arc at any desired pouring speed. Saves time and metal.

B. Stationary Super-Heating or Melting Furnaces, Type S. F. Designed to deliver the correct super-heat to magnesium after it has been melted in larger furnaces, and before it is poured into the molds. Can also be used for breakdown or holding. They have all safety features. Are available for cast steel pots or fabricated steel pots. Furnaces may be equipped with hoods if so desired, for the venting of combustion and other gasses. Write for bulletin No. 100.





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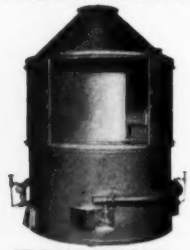

STROMAN IRON POT MELTING FURNACES FOR ZINC OR ALUMINUM

These furnaces are highly recommended as breakdown furnaces for zinc and aluminum die casting and permanent mold plants. They also excel as holding furnaces. They can be supplied either with or without hoods to exhaust fumes and heat. Their construction causes longest pot life and lowest fuel costs. Choice of automatic or manual controls and oil or gas fire. Capacities from 212 to 14,000 lbs. zinc.

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STROMAN HAND TILT CRUCIBLE MELTING FURNACE FOR BRASS, BRONZE, ALUMINUM AND OTHER ALLOYS

Capacities from No. 40 to No. 500 Crucible. Most efficient in operation. Rugged construction assures longest life and trouble-free operation. Oil, Gas or Combination Fire.

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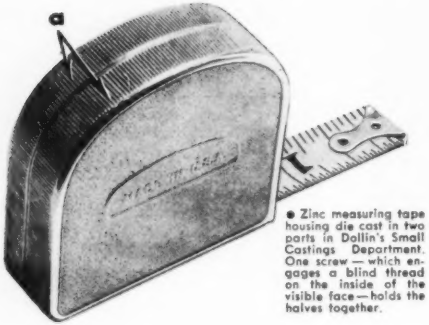
DO's and DON'Ts in DESIGNING ZINC and ALUMINUM DIE CASTINGS

examples by DOLLIN

PRINCIPLE: **Specifying serrated surfaces where good traction is desirable can cut costs while it improves the product.**

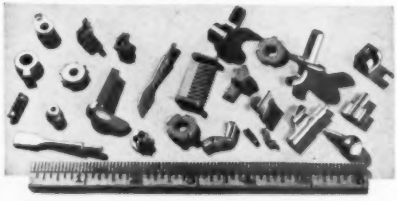


• Zinc measuring tape housing die cast in two parts in Dollin's Small Castings Department. One screw — which engages a blind thread on the inside of the visible face — holds the halves together.

EXAMPLE: The manufacturer's original design for this measuring tape housing called for a polished surface around the entire edge a. Dollin engineers suggested incorporating the serrations (as shown) in the die castings so that (1) the polishing operation would be eliminated, (2) the housing would provide a better grip.

RESULT: Reduced costs and an improved product for the manufacturer.

SMALL ZINC
DIE CASTINGS TO 3 OZ.
Made in our special
SMALL CASTINGS DEPARTMENT



• High speed automatic casting machines with small single or double cavity dies permit widest design range, provide high production with low die and casting costs.

DOLLIN engineers will work with you on design refinements, recommending whatever changes will simplify the die casting operation, improve the soundness of the castings, or eliminate machining, finishing, or assembly operations. They have at their disposal extensive, modern facilities, and are thus free to adapt designs for lowest final cost.

Dollin can efficiently produce all commercial sizes of die castings—facilities include large plunger zinc machines, large and medium size cold chamber high pressure machines, and a separate small castings department (see left). Write for estimates and engineering advice, at no obligation.

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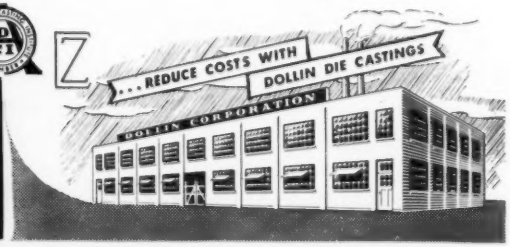


For additional information circle No. 16 on the Reader Service Card

IRON POWDER: a non-allocated metal

- how much is available?
- what are its military uses?
- are sufficient press and sintering facilities available?
- how can it be used as an alternate or substitute for other metals?

By PHILIP R. KALISCHER
Associate Editor

IN the midst of shortages, allocations, and governmental restrictions dealing with the use of metals, there is one bright spot. Thus far, there have been no restrictions of any sort placed on the manufacture or use of iron powder.

This lack of control is understandable when one realizes that practically all of the iron powder used, particularly for bearings and structural parts, is derived from waste materials such as mill scale or high grade ores which do not exist in sufficient quantities to interest the steel companies; that most of the iron powder used in the United States is imported from Sweden; and finally, that in the history of the iron powder industry there has always been an excess of production over consumption.

There is, today, a growing realization among designers and production men that iron powder may be one of the best answers to the increasing shortages in other metals and fabricated forms of metals. This realization is not, however, sufficiently impressed on the minds of engineers for them to have utilized iron powder and powder metallurgy to even a fraction of its potentialities.

Just what substitutions can be made economically cannot be predicted, of course. Some suggested changes, however, are: replacement of cast and/or machined brass parts which are not subject to high tensile stresses, particularly where the final part can have a black oxide finish; replacement of bronze bushings by powdered iron bushings; small parts machined from steel bar stock, whether hardened or not hardened. In most cases production men will find that the number of parts which can be made from iron powder is quite large, and that the *engineers from the powder fabricating companies will be able to determine quickly and easily whether or not contemplated changes are feasible.*

How much iron powder is available now and what are prospects for the future?

Before considering what changes can be made, and what the present outlook is for the use of iron powder in defense, it will be well to consider the present production and the contemplated increased production of iron powder.

During 1951, the total shipments of iron powder in the United States amounted to about 15,000 tons. This includes iron powder for all uses. Of this amount, approximately 11,000 tons was imported from Sweden.

The case for iron powder

- There is and probably will continue to be an adequate supply of iron powder for all military and civilian uses.
- At present there are no governmental restrictions of any sort on the production and use of iron powder.
- For many structural parts, iron powder is an adequate substitute, particularly in those cases where stresses are low.
- Iron powder parts can be hardened to the same degree as parts made from wrought stock.
- Adequate finishing methods are known so that both corrosion resistance and pleasing appearance can be given to parts made from iron powder.
- Powdered iron parts can be machined.
- Redesign may be necessary in some cases, though this will generally be of a minor nature.
- In many cases, the final cost of a part made from iron powder will be lower than the part it replaces.
- Many bearings and bushings now made from brass and bronze (including powdered bronze) can be made from powdered iron, oil impregnated, and substituted directly with no design changes needed.
- Parts now being made from an iron copper powder mixture can be made from pure iron if the proper processing is used.

with only minor imports from other countries. The total domestic production (including Canada) came from five or six producing companies.

Consumption figures are not available, but they very nearly equalled the 15,000 ton figure. This near-balance was achieved only because the importers and producers were disinclined to carry large inventories, and not due to any lack of production facilities.

For the immediate future, expansion plans which have been announced indicate that by the end of 1952, there will be production facilities in the United States and Canada capable of supplying about 50,000 tons of iron powder per year. This production includes only powder metallurgy grades of iron powder. Expansion plans which have been announced include:

Ekstrand and Tholand, Inc. building a plant in New Jersey to handle either high-grade Swedish or South American ores. This plant will have a materially greater capacity than any imports yet made.

One Canadian producer has announced plans to increase productive facilities by 300 percent.

Plastic Metals Division of National Radiator Corporation has engineering plans almost completed for expansion of its sponge-iron plant. This expansion will more than double their present capacity.

The Alan Wood Steel Co. is reported to have plans completed for a plant to produce sponge-iron powder from their Dover, N. J. mines.

The Pyron Co. plans to expand its present facilities to some two or three times present production.

Tacoma Powdered Metals Co. is reported to be considering the doubling of its capacity.

Metals Disintegrating Co. is back in the market with an iron powder, but its probable production is not known at this time.

Ventures, Ltd., of Toronto, Canada has announced that a plant is being erected at Cap de la Madeleine Quebec. The new plant will be capable of producing ten tons of iron powder per day, an increase from present plant capacity of two tons per day.

Based upon these announced and contemplated expansion plans, the outlook for iron powder for the next year is excellent. Excepting the possibility of a major war, this anticipated 50,000 ton capacity can still be augmented by Swedish and other imports, so that the possibility of an iron powder shortage in the United States appears to be extremely remote.

How much iron powder will be required for military uses?

What, then, are the probable uses of iron powder? Considering first the military, there is the much talked about production of rotating bands. There has been a great deal of premature enthusiasm about this part. Some fabricators and some ordnance men were so sure of the ability of powder metallurgy to do the job, that they went off the deep end. The net result has been to set back the entire program very materially.

According to ordnance personnel, the only rotating

SIXTY THOUSAND POUNDS of sponge iron powder are shown above ready for shipment from Ferrum Limited, Cap-de-la-Madeleine, Quebec, to the United States. Agents in the United States for Ferrum are Charles Hardy, Inc., of New York.

band which has been accepted so far is the 90 mm. This band has been released on a limited production schedule, so that large scale firings can be made. One of the major difficulties which had to be overcome before even test firings could be made, was the corrosion of the band in storage. The ordnance department required that the bands withstand 250 hours salt spray test. Adequate corrosion resistance has been achieved only very recently.

There is some indication that the 105 mm. band may be released for limited production at some time in the future, and possibly the 20 mm. band, although this latter one is still very doubtful. All-in-all, the need for large tonnages of iron powder for rotating bands does not appear likely within the forseeable future.

Other ordnance parts which may develop into a considerable tonnage use of iron powder are: Small gears and bearings, parts for fuses, boosters and other timed firing devices, spacers for propellant sticks in rockets, and a few others.

None of the uses cited above will take more than a fraction of the contemplated output of iron powder unless there is another all-out war. This leaves a large tonnage of iron powder which can, and should, go into civilian goods.

In the latest list of Basic Materials and Alternates published by the Department of Commerce, and released August 27, 1951, iron powder is listed as being in very short supply. This listing is unquestionably based upon over-optimism in connection with the rotating band program. That it has failed to develop and, in fact, never existed, is only one example of the over-enthusiasm mentioned above in connection with this program.

Should the band program develop, as some of its proponents predict, it will mean that this country is engaged in an all-out struggle, and under those conditions it will be of slight importance whether there is any iron powder for civilian goods or not.

Many designers and production men will be inclined to discount the statements attributed to ordnance. In the past, it has been unfortunately true that there has been little coordination of military purchasing efforts along these lines. Due primarily to the efforts of Capt. John Dale of Frankfort Arsenal, a committee has been set up to coordinate all military work on powder metallurgy. This committee meets under Capt. Dale's chairmanship monthly, to chart the future programs.

So far, this sintered iron coordinating group has been able to prevent duplication of effort, and is making progress in steering the military along lines which have the greatest likelihood of success. The work of this committee will do much to prevent unsound uses of metal powders which, if allowed to proceed, could

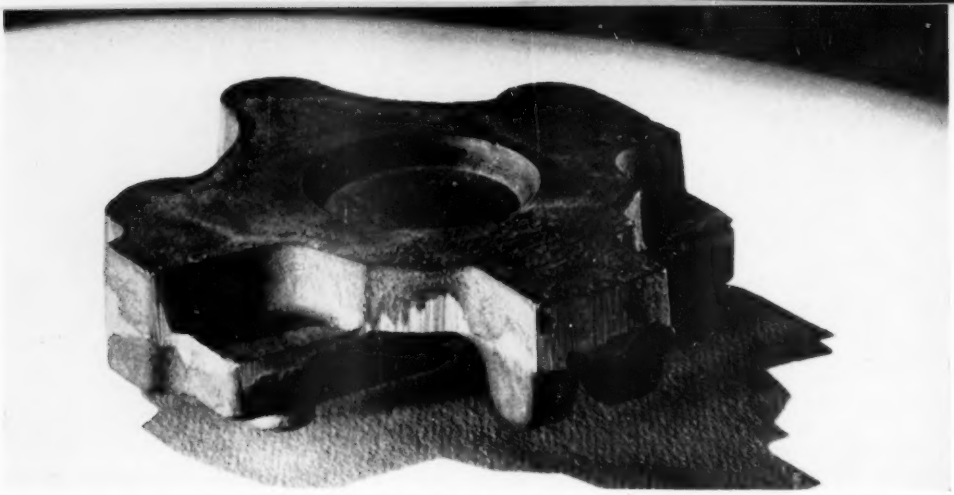
continued on page 54

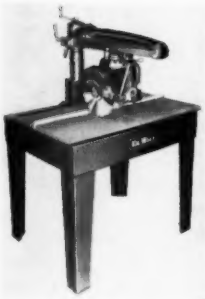
More data on iron powder parts . . . .

Following this introductory article, the editors of PMM will offer four supplementary articles with specific design information to help in using iron powder parts:

Low density iron powder parts—Since most iron powder parts now used are in the low density range, two articles will be devoted to this subject, including data on physical and mechanical properties, processing and general design considerations. The second article will be a case history showing where and how these parts have been applied.

High density iron powder parts—To produce parts from iron powders having properties equal or superior to those of wrought stock, new pressing, sintering and coining techniques have had to be developed. This recent development will be discussed, together with complete fabricating details, physical and mechanical data, and a complete case history with statistical charts on dimensional accuracy and costs. Two articles have been prepared on this important subject.





HIGH DENSITY GRAY IRON CASTING by permanent mold gives a stronger crosshead, **above**, than was attainable by previous sand casting methods. This heavily loaded piece supports the entire static load of saw and motor for the radial arm saw, **left**, and is subjected to thrust during operation of the saw. The recess cored into the center of the casting has helped to reduce critical section thickness and virtually eliminated porosity and the resulting high rate of rejects.

UNIFORM GRAIN STRUCTURE favors

permanent mold over sand for gray iron castings

FOR certain heavily stressed parts such as the crosshead which supports the weight of motor and saw on some of their radial arm saws, DeWalt Inc. has switched over from gray iron sand castings to gray iron permanent mold castings.

They have been able to get more uniform grain structure while, at the same time, taking advantage of somewhat closer dimensioning. In fact, the two advantages appear to be related.

Stock allowances for scale removal have been reduced from 1/8 to 1/32 inch, and while there remains extensive grinding and machining of surfaces, the pieces are cast relatively close to size. This allows the casting of thinner, more uniform wall sections, with a more favorable rate of chilling. The result has been virtual elimination of porosity in areas that are loaded.

For example, the crosshead on DeWalt Model GW saw carries a heavy static load and also is subjected to considerable thrust when the saw is in operation. The center pad from which the saw and motor unit is supported, at one time had a tendency toward porosity. With sand cast crossheads, rejection rate was high because machining opened up blowholes which had a weakening effect.

High density of die cast aluminum gives rotors with high efficiency

The crosshead permanent mold casting in Figure 1, shown from the underside, reveals the recess cored beneath the pad to secure thinner section and reduction of porosity.

The crosshead is only one of a large number of parts which have been converted to gray iron permanent mold castings. Others include such parts as base castings and end blocks not requiring high Brinell, but where lowered costs, better surface and improved soundness are needed.

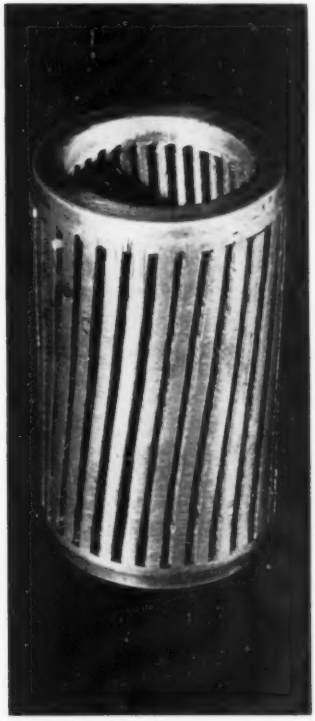
Comparison of costs on the roller head indicates the relative economy of permanent mold over sand casting. Figures for finished piece prices including burden show a saving of 47 per cent. The reduction in machine operations in the plant easily pays for the added cost of molds over normal production runs.

In another category of part, DeWalt saws get a similar combination of accuracy plus lowered costs. This is a group of motor components including rotors, end bells, fans, fan housings, relay boxes and stator end rings—all die cast in aluminum with a Lester-Phoenix 300-ton machine.

Of these, the rotors present what is probably the greatest casting problem. To inject commercially pure aluminum under pressure so that it flows uniformly through a stack of laminations requires skill. The tendency of the metal to chill as it flows, leaving foliation and porosity, must be overcome because the higher the density and the more nearly the rotor approaches a solid bar in structure—the higher the efficiency. Metal temperature is pyrometrically controlled within 20 degrees because of the effect upon electrical characteristics.

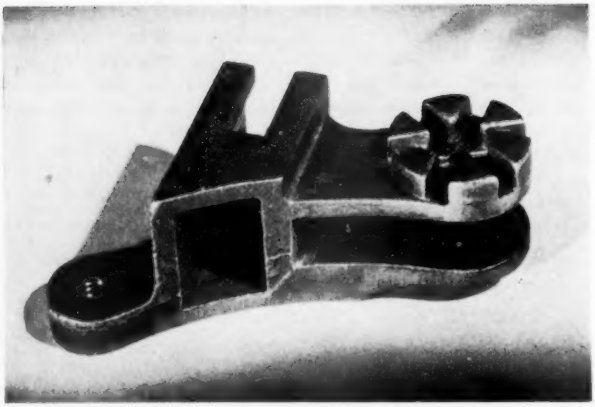
continued on page 63

BECAUSE AIR entrapped in porosity serves as an insulator, it is necessary to get the highest possible density for rotors. To investigate the density of its die cast aluminum rotors, DeWalt engineering department had all laminations machined out, leaving only the skeleton shown. They found an almost solid bar-effect because of the high density.

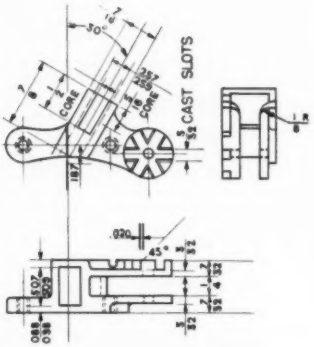


FOR GREATEST ECONOMY, many parts of small motors are die cast in a copper-silicon alloy of aluminum. Complete motor assembly and some representative end bells and stator frames are illustrated below. These parts are nearly ready to assemble as cast and trimmed

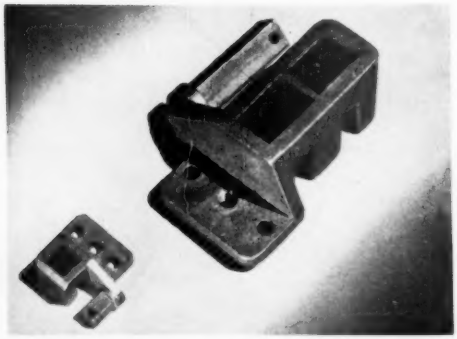
BRUSH HOLDERS: typical electrical components by *Investment Casting* . . .



1a. COMPANY ENGINEERS HAD TO BE CONVINCED that investment casting would do the job, and this brush holder was the first application of the process. It was first made using the same drawings as had been prepared for sand castings, and therefore failed to show cost reduction. It was subsequently redimensioned for investment casting and reduced the cost by eliminating most secondary operations.



1b. PROPERLY DIMENSIONED drawing for investment casting: all tolerances are as close as needed for utilization, and as open as possible to facilitate casting.



2. BY FREEING MEN AND MACHINES previously used for finishing operations, these two typical investment cast brush holders represent lowered cost and improved production scheduling. In some places wall sections are cast as thin as 1/32 inch.

3. BERYLLIUM COPPER IS USED to investment cast the reverse valve handle, **left,** and the reversing valve, **center,** reducing costs in the neighborhood of 70 percent. By investment casting the trigger, **right,** four machining operations were eliminated.

. . . three steps from trial casting to multiple applications

STARTING with a single part of which, frankly, the design engineers were skeptical, Chicago Pneumatic Tool Co., of Utica, N.Y. has expanded its use of investment castings to some 65 different castings currently in use.

From first trial . . .

On their D. C. Rotary Coal Drill, Chicago Pneumatic formerly used sand cast, bronze brush holders. As received from the foundry these brush holders had to be machined all over, this included broaching the rectangular hole into which the brush slipped. While the first cost of the casting was low, by the time the machining operations had been completed and the defective castings rejected, the cost seemed unnecessarily high.

Engineers of the Precision Metalsmiths of Cleveland, Ohio, proposed that the brush holders be investment cast in the same bronze that was being used for the sand castings. They also proposed that the part be redesigned somewhat to take maximum advantage of investment casting. The first suggestion was finally accepted on a trial basis, but the second one rejected. Some brush holders were made using the same drawings as were followed for sand casting and, as might be expected, were little if any better than the sand castings. They still had to have the brush hole broached.

To redimensioning . . .

Further examination of the part and consultation with the casting engineers resulted in a slightly modified brush holder that presumably could be used in the as-cast condition. Again, trial castings were made and this time fitted perfectly into the coal drill without any machine work at all other than to tap two holes. All of the requirements dimensionally (mostly tolerances of 0.005 except in the brush slot where a total variation of 0.002 is held) were met and the surface finish was more than adequate for the job.

That the brush holder is not a difficult part to make, from the investment caster's point of view, can be seen from the photograph and drawing in Figure 1. The importance of this piece is that it opened to the designers a field of metal forming with which they were unfamiliar. The initial success only served to whet their appetites to re-examine as many parts as possible with the idea of converting to investment castings.

Other brush holders naturally followed the first one, two of which are shown in Figure 2, varying in size from the very small one illustrated up to those carrying three or more brushes. In these large sizes another problem was presented.

. . . and multiple uses

So long as only one brush was to be carried per holder, all of the parts could be made of such a size that the brush assembly could be put into the space available. As the size of the holders increased the limitations of brush manufacture required two, three or more separate units. For economy of space the partition between any two brushes had to be kept thin. With machined castings, this thin section could only be achieved at the cost of more machining, thus increasing the finished cost of the holder, and if the number of rejects was to be held down the wall of the spacer between the brush segments had to be rather thick. With investment castings this separator can and is cast as thin as 1/32 inch. This reduction of thickness may seem trivial, but in some cases can be the deciding factor in design.

Obviously in such a review as this one, it is not possible to list and describe all of the many castings used by Chicago Pneumatic. The three castings illustrated in Figure 3 are typical of the entire group.

The reversing valve handle shown in Figure 3 is a beryllium copper casting. Formerly a malleable casting, five separate set-up and machining operations were required to finish it. As investment cast, the handle is used as received from the foundry. The cost reduction in this case is remarkable. The malleable casting when fully machined and ready for installation in the tool cost $2.19, the present beryllium copper investment casting costs only $0.67.

The reversing valve, Figure 3, is another case where conversion to an investment casting showed a marked reduction in cost. This part was first designed to be machined from bar stock with the handle added in a separate operation. Some ten machining operations plus the making and attaching of the handle were required. The beryllium copper investment casting requires only three machining operations and the cost of the part has been reduced from $2.25 to $0.73. The handle is of course, an integral part of the casting.

Finally, the trigger, Figure 3, is another conversion from the more usual forming methods to investment casting. Here again cost was the deciding factor. Four machining operations were eliminated and the cost reduced 50 percent.

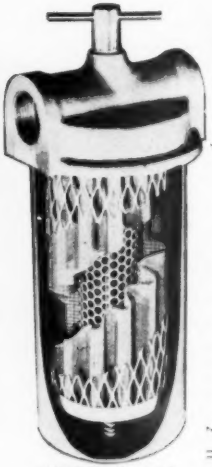
A further advantage of investment castings is found when subsequent machining operations are necessary. Due to the increased accuracy of the investment castings all locating points are more accurately positioned. This frequently makes possible the use of less expensive and involved jigs thereby reducing the machining costs.

All of the parts described were outstanding in that they showed a marked reduction in manufacturing cost. There is, however, another saving that can not be given in dollars, but which is, in many cases, the dominant factor in the change from one forming method to another. When shop facilities are extended to their utmost as they are today, and when new machine tools are difficult to get, any change in design or manufacturing procedure that will free men and machines constitutes a real production economy.

MAINTENANCE TROUBLE? PRODUCTION LOSSES?

PUMP FAILURE ? LEAKY VALVES ? EXPENSIVE REPAIRS ? DOWN TIME ?

SUMP TYPE (Cutaway)



LINE TYPE (Cutaway)

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Plaster Mold Casting

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for the designer

ONE of the greatest assets which the plaster mold casting process offers the product designer is the considerable latitude open to him with regard to coring.

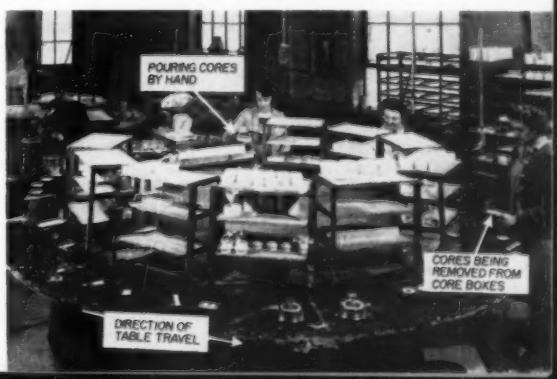
Plaster molds for casting non-ferrous metals are assembled in cope and drag sections, cast with a wet slurry of gypsum plaster over patterns which are machined from brass and set into flasks, as illustrated above.

The separate cores are cast in individual core boxes, as illustrated by the circular, rotating table below. The cores are then placed into the mold where they must be adequately supported and located by the core prints.

For holes formed by separate cores, the product designer has almost unlimited freedom concerning undercuts, elimination of draft, reentrant angles and other internal forms which could not be formed if the core needed to be withdrawn after casting. Plaster molds and cores are destructible, just as sand molds are, and thus it is possible to combine elaborateness of internal coring as in sand casting, with the accuracy of the smooth-surfaced, closely controlled plaster molding material.

A few of the advantages and limitations on cored holes are suggested here:

- Cored dimensions can usually be held to ± .005 per inch when formed by a separate core.
- Ordinarily, it is not necessary to allow draft on separate cores, although if the hole is formed by the brass pattern from which the cope or drag is produced, then draft of ½ to 1 degree is usual.
- Complex cores are entirely feasible, so long as it is possible to support the cores properly in the mold.
- Plaster cores can be removed from cored holes quite easily after casting.
- Holes smaller than ½ inch in diameter can often be drilled at lower cost than to attempt coring.
- Thread forms, spiral grooves and splines are frequently possible by coring.



PMM DESIGN TIPS suggested by current practice at Indian Motorcycle:

- When there is a problem of heat dissipation, die cast aluminum with deep, thin fins will give maximum performance.
- Where smooth surfaces and accurate dimensions are needed in a part which has an undercut that cannot be formed by a regular pulled core, permanent mold castings with sand cores may do the trick.
- Polished aluminum costs much less than chromium plated steel.
- When sections are carefully designed, the porosity which causes oil seepage can usually be eliminated in die cast crank case and transmission housings.

"WRAPPINGS" FOR THIS POWER PACKAGE

are die cast wherever cores can be pulled; permanent mold cast with sand cores where there are undercuts

By WM. BEECHER
Manager Inspection Dept.
Indian Motorcycle Co.

THE Indian Motorcycle Co., has converted, wherever possible, to die castings on its light and medium duty models as a weight saving and cost reducing procedure.

Fostered by a war time need for a light weight motorcycle that could be used in air-borne operations, Indian developed a rugged machine that successfully withstood dropping by parachute. The modern counterpart of this war time machine is the Warrior, a 30.50 cubic inch machine that has found favor with both the casual rider who uses it for all around cycling and travel and the enthusiast who wants top performance, speed, and maneuverability.

The Warrior weighs only about one-half as much as the larger Chief and much of this weight saving is due to the use of aluminum die castings and aluminum permanent mold castings wherever possible. In no case, has either strength or safety been sacrificed in order to utilize the molded aluminum parts. The list of die castings and permanent mold castings reads like a roster of major motor housings and components.

Better heat dissipation is due to die cast aluminum block

The cylinders are cast in pairs utilizing two centrifugally cast iron sleeves as inserts in a die cast aluminum

Heat radiation increased 50 % with die cast cylinder

block on which the cooling fins are integral. Through the use of an aluminum die casting for this part it is possible to decrease the thickness of the fins and the spacing between them.

Thus, an increase in radiation area is secured with the same over-all physical dimensions as an iron casting. The Warrior has a total of 720 square inches of radiation area per pair of cylinders, an increase of about 50 percent over the area that could be secured in a cast iron cylinder.

Tolerances specified on the casting drawings are normal for the die casting industry, that is about 0.003 per inch. Mating surfaces where the cylinder head and the crank case fasten on are machined to secure the required flatness. Although gaskets are used at all mating surfaces, a die cast finish is not adequate. All holes for bolts and studs are drilled and tapped after casting. For this part a 14 percent silicon aluminum alloy is used.

Sand cores are combined with permanent mold for the head and pistons

The design of the cylinder head and pistons involve internal undercuts and re-entrant angles that cannot be die cast. For this reason, Indian uses semi-permanent mold castings of a copper-silicon-aluminum alloy.

The permanent mold is standard in every respect except that where metal cores could not be withdrawn from an intricate hole, a sand core is used. This combination of steel mold and sand cores takes advantage of features of both casting methods and allows far more complex parts to be made at reduced cost.

The valve guide bushings, valve seats, spark plug receptacles and wrist pin bushings are either cast as inserts or are chilled and pressed into cored, machined holes.

This latter practice of refrigerating the insert to shrink it and then pressing it into the casting is used a great deal by Indian. After cooling to about minus 40 F. the insert is lightly pressed into place. As it warms to room temperature the insert expands and is held firmly in place.

As in the case of the cylinder block, all mating surfaces on the head are machined after casting and all threaded holes are drilled and tapped.

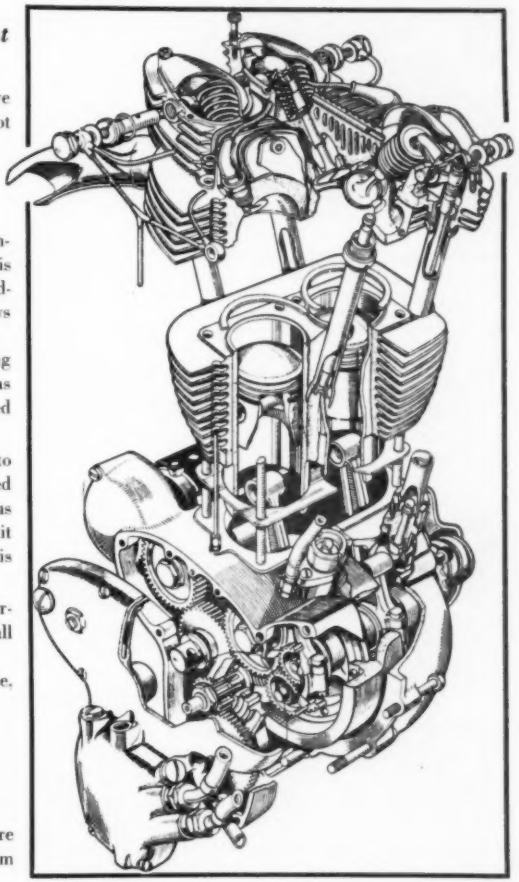
The outside surfaces of the pistons are, of course, machined all over.

Polished aluminum costs less than chromium plated steel

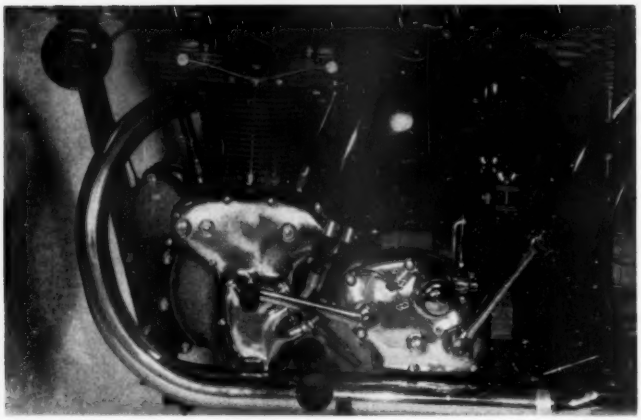
Motorcycle riders are rather notorious in the desire to have machines "flashy". The rocker arm covers, cam case cover and transmission cover are parts that, if made from steel would normally be chromium plated. Through the use of die cast aluminum covers, however, the only finishing operation needed is to polish with a cloth buff using fine Tripoli as a polishing agent.

This finish is comparable to chromium plating in appearance and is far more stable, there being nothing to peel off or develop rust spots at pin holes.

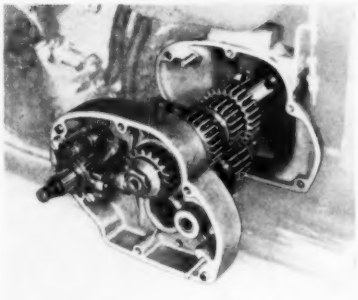
Both the rocker arm covers and the transmission cover seal out dust and dirt and prevent oil leakage from



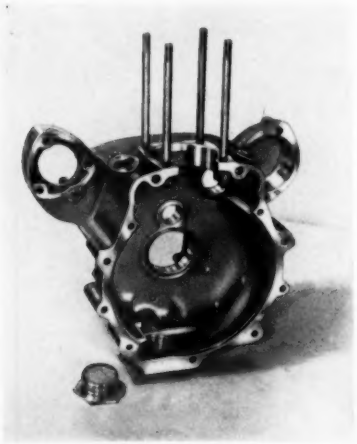
ALMOST TOTALLY ENCLOSED in aluminum die castings or permanent mold castings, this power plant for a lightweight Indian motorcycle has both the "flash" and ruggedness that motorcyclists demand.



POLISHING WITH A COTTON BUFF and tripoli is the only operation needed to develop the high lustre which can be seen on these die cast aluminum covers.



UNIFORM WALL SECTION is one of the best ways to circumvent porosity problems. The 3-piece transmission housing (cover not shown) uses both die cast and permanent mold cast aluminum pieces which are dense enough to prevent oil seepage.



ALL MATING SURFACES are machined to provide best possible gasket seal. No attempt is made to cast these surfaces flat enough.

the mechanism. The cam case cover in addition to serving these same functions, has the oil pump housing cast as an integral part of it.

The oil pump itself is of the gear type and uitilizes either cast iron or powdered iron gears. The cover for the oil pump is die cast aluminum.

The oil pump itself is of the gear type and utilizes Indian machines all mating surfaces. The gasket faces are only from $\frac{1}{8}$ to 3/16 inches wide and an extremely flat surface is required if a good seal is to be secured.

Oil seepage is no problem

Some designers fear to use die castings or permanent mold castings where there is a danger that porosity might result in oil seepage. There are cases, fortunately rare, where the porosity of a casting is due to faulty foundry practice. Most frequently, however, when porosity occurs the trouble can be traced to the design of the casting.

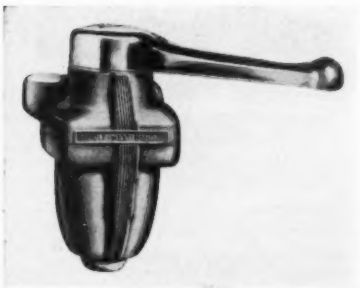
As an example, if a heavy section is positioned so that it must be fed by a thin section, porosity is likely to occur. Other reasons exist, of course, which cause porosity. Realizing that seepage due to porosity in both the crank case and transmission case would cause a most unfavorable reaction, the engineers and the engineers from the casting companies worked together to develop a design that would give castings of maximum density. The result of this cooperative work is the freedom from leakage and seepage in both the crank case and the center section of the transmission case.

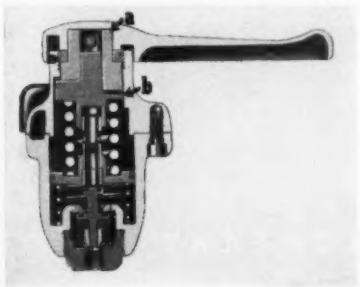
The crank case design is such that die casting does not lend itself well as a manufacturing procedure. For

continued on page 56

Variations in the direction of pressing made it tough to get uniform density on these powder metal cams. Here is a study of the way it has been accomplished.

Bronze cams and iron followers in matched sets by *Powder Metallurgy*





1. HEART of this hand-operated brake control valve, **above**, is the cam and follower assembly, shown in section view **below**. Follower is (a) and cam is (b).

TO generate a cammed surface involving several graduated planes, and then to develop a follower with inverse camming surfaces, represents a formidable job by any conventional machine shop methods. Even with a duplicating machine and master pattern, this would be a laborious and expensive operation, success of which would depend too much upon the human factors of skill, judgment and fatigue.

Consider an example of this type of job.

Bendix-Westinghouse Automotive Air Brake Company in Elyria, Ohio, produces a hand-operated control valve, Figure 1, for use with truck trailers to give independent braking action on severe grades, icy roads and other hazardous driving conditions. The heart of this air-actuated auxiliary braking system is a complex cam and follower, Figure 2, which translate rotary motion of the control handle into vertical motion for valve operation.

Function of the control unit is such that extremely close dimensional tolerances had to be specified for the cam and follower in two planes: vertically between the base and cam rise, and horizontally between ID and OD for concentricity. Reference to drawings in Figures 3 and 4, including developed views of the cams, will verify this closeness.

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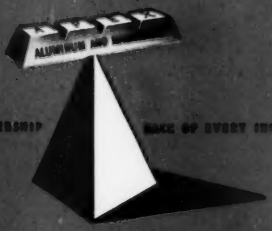

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2. MORE THAN 5 MILLION cycles of operation have been run in service testing without resulting in any appreciable wear on the camming surfaces.

The job of forming these components was conceived from the start as a powder metallurgy application, not because it would be an easy job by this process, but there appeared to be no alternative method by which it could be accomplished on a production basis.

The cam was specified as sintered bronze and the follower as sintered iron. Dissimilar metals were chosen for wear and bearing properties. Watertown Manufacturing Company of Watertown, Conn., undertook the molding and sintering.

Density is a problem when thickness varies in direction of pressing

One of the most apparent problems in the production of cams such as these by powder metallurgy is the variation in section in the direction of punch motion. The need for uniform density in the pressed piece is of most critical importance, for mechanical requirements of the finished part, and for its effect upon dimensional control during sintering.

A piece of this type can only be formed on a press having multiple punches, synchronized in such a way that the mass of loose powder which is hopper-fed into the die becomes evenly distributed between thick and thin sections.*

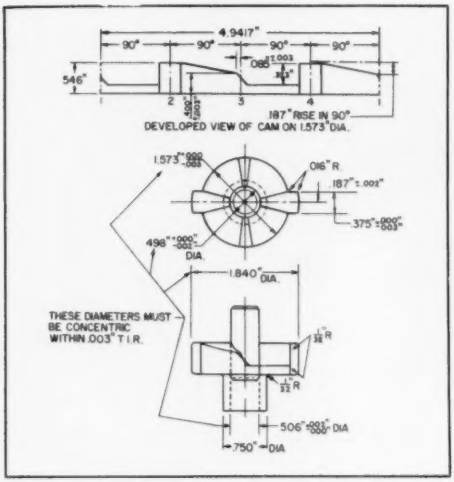
Since finish dimensions must be held very close, the density of the powder compact also has to be controlled. Otherwise, warping during subsequent operations would negate the most careful die construction and setup.

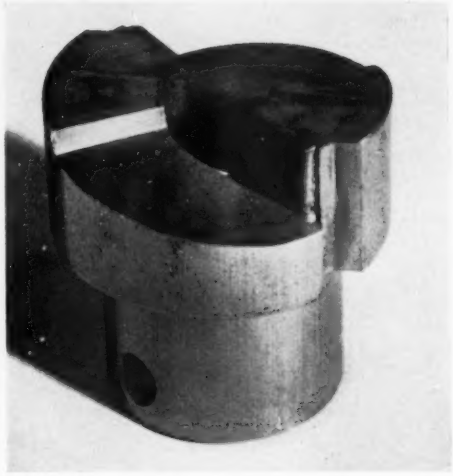
Changes in design, dimension and radius facilitate production

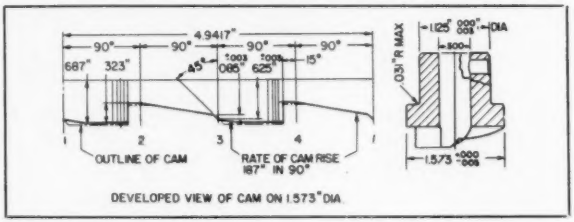
While the variations in section thickness are inherent in the shape of the cam and follower, so that nothing could be done to alleviate this problem faced by the powder molder, the design engineers at Bendix-Westinghouse did work closely with the vendor to remove other difficulties. Most of these changes consisted of slight opening up of dimensions, although there was one design change, and several radii were introduced where they would improve ejection or prevent cracking of the compact.

As originally designed, the central stem of the cam was to be an integral part of the piece, but it was

*For a discussion of the problem faced by the fabricator, see the inset item on page 39.







3. DIAMETERS AND CONCENTRICITY are held to extremely close dimensional limits, while vertical dimensions between faces of the punches have been relaxed slightly, as shown on drawing of the cam. **top left.**

4. A RADIUS between perpendicular surfaces helps to prevent cracking during ejection or sintering. **bottom left.**

5. THE IRON FOLLOWER is produced from powder using a step die. Cams and followers are 100 percent torque tested.

found to be entirely impractical, and the design was then altered so that the stem could be cut from bar stock and pressed in with an interference fit. The presence of an integral stem would have introduced one additional thickness variation, an extra problem of cracking where the stem meets the cammed surfaces, and an impossible job of dimensional control.

A number of changes were made in dimensional tolerances, all in the direction of punch motion. For example, the .400 dimension on the developed view of the cam, Figure 3, was changed from ± .002 to ± .003, and the .546 and .323 were opened up from ± .003 to the standard decimal tolerance of ± .005.

It has been pointed out many times, but bears repeating, that the mechanics of powder metallurgy, or of any other precision metal molding process, determines to a large extent the closeness of tolerance which can be attained between any two given points or surfaces. The designer who works closely with the custom fabricator to iron out incompatabilities between specified tolerances and feasible commercial limits, is most likely to obtain a successful finished piece produced at minimum cost.

In some instances, it may be possible for the molder to come closer than common commercial tolerances, while in others, the fabricator may ask extra leeway. Thus, although some slackening of vertical tolerances between punches was desirable for these cams, the horizontal and circumferential tolerances are held exceptionally close.

Reference to Figures 3 and 4 will reveal that total indicator reading for concentricity of three diameters must be within .003, while a bore diameter of about a half inch is held to + .002 — .000 and an OD of 1.573 is held to + .000 — .003.

Importance of radii and fillets to improve fabricating characteristics

One of the most significant changes which Bendix-Westinghouse designers have made in detail of the cam and follower is the introduction of radii and fillets.

A troublesome feature of the cam, insofar as powder metallurgy is concerned, was the intersection of the base of the cam with the hollow shaft, Figure 3. At the intersection of the bottom of the cam and the .750 diameter, considerable difficulty was encountered due

to cracking. The notch effect of the sharp corner during ejection and sintering resulted in a high rate of rejects. By the simple expedient of introducing a 1/32 inch radius, this problem was quickly overcome.

On the follower, a similar problem existed, but it was not possible for the designer to allow as large a radius. Thus, a .031 maximum radius has been permitted at this point.

At the outer edges of the cam body, likewise, radii have been introduced. It is almost impossible to obtain a sharp edge between the punch and die, and the specification of a radius eliminates haphazard chipping or breaking of the edge.

Successful production is the proof of the pudding; pass service testing

It must be pointed out that the cam and follower are not *typical* or *easy* parts to produce by powder metallurgy. The fact remains, however, that these components are now in successful production, being supplied to Bendix-Westinghouse in matched sets, and have been thoroughly tested by the company before being put into application.

In preliminary wear testing, in which the control units were put through repetitive operating cycles, the cams passed the million-and-a-quarter mark and the testing was stopped without reaching destruction

LOWER PUNCH IN 4 SECTIONS HELPS TO MAINTAIN UNIFORM DENSITY

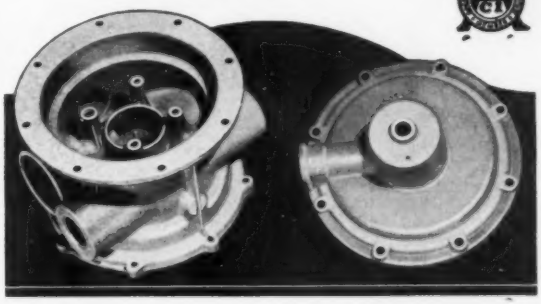
The bronze cam in the Bendix-Westinghouse control valve is an extremely difficult part to make because of several different thicknesses. It was necessary for the powder metal fabricators to build the bottom punch in four sections. These float an amount required to displace the material and distribute it as nearly proportioned to the thickness as possible.

It is difficult to have a piece of even density with such a design, but it has been determined that after coining, the density is in the 80's, with some sections as high as 90. These parts are tested 100 percent for torque and since completion of the pilot operation it has been a rarity to find a reject.

The iron cam is not quite so difficult to make. The company started by having a floating member of the bottom punch which took care of the large diameter and the shoulder. Occasionally, however, it was not possible to press both thick and thin sections simultaneously and a few failures resulted, which were picked up in testing.

Since then, new tools have been made, consisting of a solid die which might be termed a "step" die. Not a single reject has been detected in 100 percent testing of several thousand pieces since that time. These pieces are also coined after sintering, and density is held in the 80's, more uniformly than is possible on the bronze cam.

"CLEVELAND"



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For additional information circle No. 15 on the Reader Service Card

because this figure is many times the full service life of the units. In other tests, carried out to test other components of the control valve, the cams have seen more than 5 million cycles of operation resulting in negligible wear on the camming surfaces.

This set of cams represents the achievement of a difficult part on a quantity production basis which, a few years ago, would have been considered impossible. Credit for this accomplishment is shared by the fabricator, die designers, builders of multiple punch powder metal presses and developers of efficient sintering equipment. Likewise, credit is due the Bendix-Westinghouse design department for a cooperative approach and willingness to work out difficult problems which might easily have derailed the entire project.

SEEK TO ALLEVIATE NON-FERROUS SCRAP SHORTAGE

Formation of a non-ferrous industry scrap mobilization committee to find a solution to the growing crisis in non-ferrous scrap has been announced by the National Production Authority, U. S. Department of Commerce. Meeting in New York the committee elected the following permanent officers: T. E. Veltfort, Manager, Copper and Brass Research Association, New York City, Chairman; M. L. Tressell, Aluminum Company of America, Pittsburgh, Pa., Vice Chairman, and Paul Herzog, Federated Metals Division, American Smelting and Refining Company, New York City, Secretary-Treasurer.

The executive committee is composed of the foregoing officers and the following others: John Lennon, American Metal Company, Ltd., New York City; L. S. Thomas, General Smelting Company, Phila., Pa., Donald S. Levinson, Tomka Aluminum Division, Baltimore, Md.; Otto Barth, Barth Smelting Corporation, Newark, N. J.; E. A. Bergman, U.S. Reduction Company, East Chicago, Ind; Samuel Friedman, Orchard Refining and Smelting Works, Newark, N. J.

LIPPERT HONORED

Maury E. Lippert, sales manager of Silverstein & Pinsoff, secondary metal refiners of Chicago, was recently honored on the occasion of his fiftieth birthday and eleventh year as sales manager with the company.

ALUMINUM AID ON WAY FROM GREAT BRITAIN

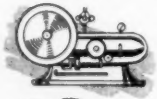
Augmentation of our critically short aluminum supply by over 22 million pounds will be the result of a reciprocal agreement entered into by this country and Great Britain. The aluminum, to be delivered in five monthly shipments, is being produced in Canada and will be diverted from purchases previously made by Great Britain. This country, in return, will allocate to Great Britain a similar amount of aluminum out of our production, beginning the last quarter of 1952 when a considerable portion of our aluminum expansion program will have been completed.

In making the announcement, Manly Fleischmann, administrator of the Defense Products Administration which handled the negotiations, said that he hoped it would be the first of many similar instances of cooperation among nations of the free world toward solution of the current acute international shortage of metals.

LET'S RATE YOUR *Product* FOR...

EYE APPEAL

FUNCTIONAL DESIGN



EFFICIENT PERFORMANCE

ECONOMICAL PRODUCTION

Want a tried-and-true method of keeping your sales and profits up? Just rate your product from the practical viewpoint of the buyer.

We'll be happy to discuss any of the above points with you and show you how Badger die castings can improve the looks and efficiency of your product, as well as reduce its overall cost.

For additional information circle No. 11 on the Reader Service Card

FINISHING SECTION

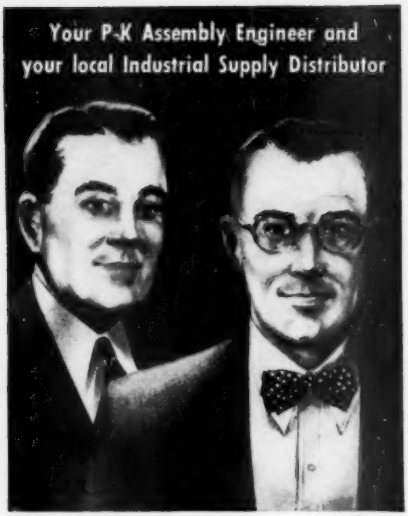
MACHINING—Most precision metal molded parts require some machining operations. In this section will be found information to aid in planning and selecting the proper methods and equipment for these operations.

ASSEMBLING—Precision metal molded parts are generally components of assemblies. This section includes information on fastenings and methods for mass production assembly operations.

SURFACE FINISHING—Many precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used for these surface treatments.

A Section Devoted To the Finishing Of

Die Castings
Investment Castings
Powder Metal Parts
Permanent Mold Castings
Plaster Mold Castings



Teamed up to help you step up assemblies

Working side by side in every industrial center throughout the nation, this pair of experts is solving many difficult problems of planning and procurement.

The P-K Assembly Engineer is a fastening expert, fully qualified to help you plan faster, better, lower cost assemblies.

Your local Industrial Supply Distributor is an expert in procurement, with complete experience and facilities for simplifying your supply problems.

They can show you why Parker-Kalon Fastening Devices have made record savings in assembly time and cost in over a million applications.

Ask this top-notch team to sit in with your production staff. They'll give you the kind of help you need today more than ever. Parker-Kalon Corporation, 200 Varick Street, New York 14.

PARKER-KALON®

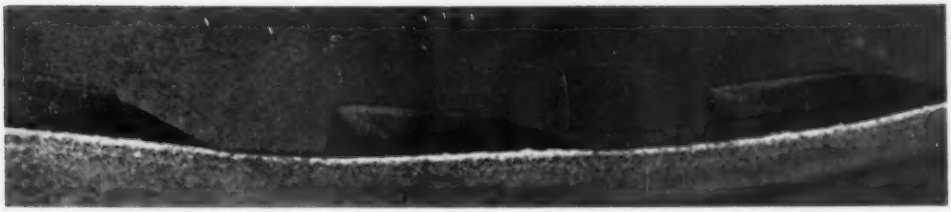
The Original **SELF-TAPPING SCREWS**

Cold-forged **SOCKET SCREWS**

AND OTHER FASTENING DEVICES

PRECISION METAL MOLDING

For additional information circle No. 72 on the Reader Service Card



THE MILLING CUTTER CONTOUR of the serrations on the "61" contact wheel is shown above. In use, belt and work piece pressure deforms the serrations so that a true chip clearance is obtained.

LONGER LIFE AND MORE UNIFORM SURFACE are obtained when a "61" contact wheel is used.

THE "61" CONTACT WHEEL showing the helical disposition and special section shape of the serrations.

LONGER BELT LIFE, LESS LOADING are reported for new type contact wheel

THE evolution of contact wheels for back stand idler type of belt grinders has been toward a wheel whose surface is designed to flex the belt as it passes over the wheel and thus dislodge embedded metal particles which cause glazing and loading of the belt.

A serrated wheel surface with the serrations parallel to the axis of the wheel gave some improvement. The next step was to put the serrations at an angle to the axis of the wheel; actually, a helical shape was used. With both of these face contours, some improvement in belt life was secured, but in order to secure a desirable degree of flexing the serrations had to be deep and thin so that the tooth was too flexible.

The latest development is a contact wheel which has helical serrations like many others, but instead of a rectangular tooth shape this wheel has teeth shaped like the teeth on a milling cutter. The effect of this shape is to flex the belt in such a manner that there is chip clearance back of the cutting edge. With this chip clearance the metal removed is not forced into the belt between the particles of abrasive and loading of the belt is reduced.

The new contact wheel, developed by the Carborundum Co. and called the "61" wheel, is reported to give improvement in belt life in most cases except where heavy snagging is involved. For this type of service, a smooth wheel still gives the best belt life.

A few reports on installations where the new type of contact wheel has been tried have been received.

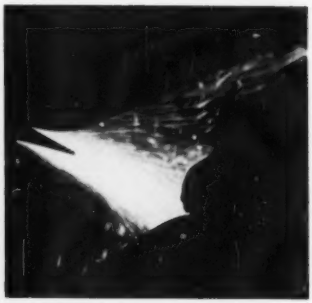
The J. Y. Taylor Company of Garland, Texas, uses

abrasive belts to finish die castings for butane tank gauges. Using a smooth, hard canvas contact wheel, the previous cycle consisted of grinding with an 80 grit belt followed by a 220 grit and finally, buffing. Since introducing a "61" contact wheel, the company has dispensed with the 80 grit operation and the buffing. A superior satin finish is reported after the 220 grit operation.

For a light snagging operation on die cast washing machine parts, Norge Division of Borg Warner Corp. in Herrin, Ill., has improved belt life from 80 pieces per belt to as high as 170.

The St. Louis Die Casting Company, processing a large variety of zinc and aluminum pieces, estimates belt life at about 50 per cent higher than before. This company uses the "61" wheel in conjunction with a Lasalco belt grinder with speed of 3600 sfpm, and belt grits ranging from 60 through 180.

Spark pattern from an abrasive belt after 24 minutes operation with a #60 Duro R51 contact wheel. Camera exposure F5.6 at 1/50th.



Spark pattern from an abrasive belt after 80 minutes using a Carborundum #61 contact wheel. Camera exposure F5.6 at 1/50th.

it's the SHAPE that counts

. . . in BURNISHING MATERIALS too.

Military insignia, brass buttons and cap ornaments often acquire their bright, smooth finish from ABBOTT Burnishing Materials. They're shaped to do the job right.

Abbott Burnishing Shapes — Ball, Ovalball, Cone, Diagonal, Pin — are scientifically designed to make effective contact on metal stampings and castings of any size or shape. Each is made from high quality, Abbott bearing ball steel, deep hardened and polished to a mirrorlike, glass hard finish. For quality burnishing . . . use Abbott.

WRITE for your copy of the informative Abbott Catalog-Manual.

THE ABBOTT BALL COMPANY
1084 New Britain Ave.
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ABBOTT

For additional information circle No. 61 on the Reader Service Card

FOUND FIRM IN ERIE, PA.

Carl Hersey and Robert B. Way, formerly with Conforming Matrix Corp. of Toledo, Ohio, have joined forces to found the Finish Engineering Co., Inc., in Erie, Pennsylvania. The new firm will specialize in the production of automatic mask washing machines, vacuum plating racks, masking fixtures and tools, spray painting masks, handling devices and automatic painting machines.

OAKITE REPRESENTATIVE GETS SERVICE AWARD

J. W. Haines, technical service representative of Oakite Products, Inc., manufacturers of industrial cleaning and allied materials, has been awarded the D. C. Ball Award for Distinguished Service by company president John A. Carter. The award is given annually to members of the firm's field organization adjudged to have rendered the most outstanding service to the industry.

TWO SUBSIDIARIES FORMED BY ALLIED RESEARCH PRODUCTS

The establishment of two new subsidiary companies has been announced by Allied Research Products, Inc. of Baltimore, manufacturers of Iridite metal finishes and ARP plating chemicals.

The first, Allied Metal Finishing Corp., will assume responsibility for the job shop metal finishing business previously conducted by the parent organization. The second, Allied Research Sales Corporation, will handle national sales of Iridite and ARP.

PANGBORN HONORS 77 VETS

The Pangborn Corp. of Hagerstown, Md., manufacturers of blast cleaning equipment, recently honored employees with 25 or more years service at a dinner for the Pangborn Quarter-Century Club. The 77 employees so honored were presented with gold wrist watches for their part in the company's success. Pangborn officials expect to make the dinner an annual affair.

ESTABLISH ANNUAL H. W. GILLETT MEMORIAL LECTURE SERIES

An annual H. W. Gillett lecture has been established by the American Society for Testing Materials in cooperation with Battelle Memorial Institute. Purpose is to commemorate Horace W. Gillett who was one of America's leading technologists, the first director of Battelle and an active worker in ASTM.

The lecture will cover a subject pertaining to the development, testing and evaluation and application of metals. The lecturer will be selected by a committee of ASTM and will appear at the annual meeting of the Society. First lecture will be delivered at ASTM's 50th Anniversary meeting in New York during the week of June 23rd next year.

PENNSALT WESTERN UNIT

Pennsylvania Salt Manufacturing Co. of Washington has completed construction and begun operations in its new plant at Portland, Ore., for production of industrial cleaners.

BARREL FINISHING NEWS

"Super Honite" chips last twice as long!

Now you can speed your barrel finishing with the world's toughest abrasive chip—"Super Honite!" It's the hardest chip ever produced—the *only* chip engineered for both grinding and burnishing. Gives twice the life of other stones!

What makes it so tough? Aluminum-oxide mineral grains—*fused* with a ceramic bonding agent that never fractures or crumbles. And "Super Honite" *holds* these thousands of razor-sharp cutting edges permanently—*can't* wear smooth.

Try it yourself and see the difference. Available in eight sizes. Write Dept. PMM-12 for the name of your nearest supplier.

ANOTHER 3M PRODUCT

Regular "Honite" proves toughest natural chip

Competitive tests prove no other *natural* barrel finishing abrasive—not even granite—retains a cutting edge as long as regular "Honite!" Thousands of tiny, sharp silica grains are held tightly in a tough mineral bonding. Thousands of new cutting edges are constantly exposed as the surface slowly wears away.

That's why "Honite" is ideal for fine finishing to close tolerances, and for many other jobs involving a minimum amount of metal removal.

Insist on the brand name—"Honite." Available in nine sizes for uniform results. Write Dept. MF-81 for the name of your nearest supplier.

"HONITE" COMPOUNDS *are the "secret of success" for dependable finishing. Each type is carefully formulated to control alkalinity, lubrication, glazing —many other vital operating conditions. Ideal with "Honite" or "Super Honite."*

FREE help from Barrel Finishing Experts!

Are you positive your present barrel finishing methods are giving you the best results at the least possible cost? Experienced 3M Engineers are ready to work with you for increased efficiency and a system that's tailored to your *particular* job. Use coupon below for complete information and a copy of "3M Barrel Finishing." No obligation.

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Dept. PMM-12, St. Paul 6, Minn.

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Honite BRAND

BARREL FINISHING CHIPS • COMPOUNDS • EQUIPMENT

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

For additional information circle No. 69 on the Reader Service Card

Prolong the life of your DIES with PANGBORN Hydro-Finish!

PANGBORN Hydro-Finish prolongs life of expensive Tools and Dies by cleaning and polishing to a precision tolerance of .0001". Jobs that formerly took hours are done *in minutes* with *Hydro-Finish!* Fine mesh abrasives are used to clean and improve surface of die casting dies, rubber and glass molds, forging dies, and deep drawing dies, without excessive metal removal.

Dies are clean, rapidly produce hardware finish and give maximum production without expensive hand maintenance! One man alone can operate a Pangborn Hydro-Finish machine.

PANGBORNITE — The best abrasive for all liquid blasting needs. Available in many mesh sizes for precision cleaning.

GET THE FACTS on Hydro-Finish!
Write today for Bulletin 1400-A to: PANGBORN CORPORATION, 3500 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment.

Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

Circle No. 71 on the Reader Service Card

Considerations in the use of INFRARED HEATING for drying organic coatings on die castings

ONE of the growing applications for infrared radiant type heating units is the drying and curing of organic coatings applied to die castings and other non-ferrous castings. This is particularly true in the consumer goods field where volume is large, work is suitable for rapid, conveyorized production processing, and costs are competitive to the fraction of a cent.

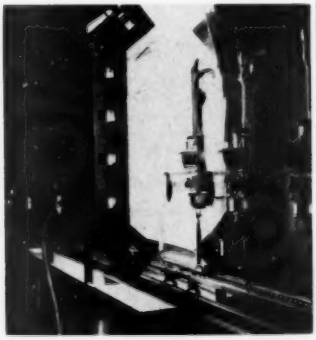
Without attempting to make a comparison with convection or induction methods, a few of the factors worth considering in the use of infrared heating are outlined here.

What is it? Infrared heating is a means of transferring energy in the form of heat from the source (filament lamps) directly to the product being finished by means of radiation. It does not require heating of the air surrounding the product.

How is applied? Infrared lamps, arranged in banks of standard, prefabricated oven sections, can be set up along the production line so that no extra handling is required. Because these infrared units are light in weight, it is often possible to mount them along a wall or ceiling where they do not consume valuable floor space.

How is drying accomplished? There are three general ways in which an enamel or lacquer dries: evaporation of the vehicle, oxidation, or polymerization.

Where evaporation of the vehicle is the basic drying method it is only necessary to provide a high enough temperature to cause evaporation to take place in a reasonably short time and a sufficient movement of air to maintain a low level of solvent vapor. For this type of drying infrared has the advantage of putting the heat where it will do the most good—that is, on the metal. Care must be exer-



INFRARED BAKING OF FINISHES at Scott-Atwater Company are applied to the complete chassis, exclusive of motor, drive and transmission, according to data from Fostoria Pressed Steel Corp. who engineered the installation. Time required for the baking cycle is 15 minutes, while gas tanks and motor covers are finished in a separate, smaller oven, using a 6-minute cycle.

ACROMARK
MEANS "ACCURATE MARKING"

ENAMEL FILL YOUR DIE-CAST PARTS with THE ACROPRINTER

Reg. U. S. Pat. Off.

Write For Latest Literature

Hand and Motor Driven Models

The ACROMARK Company

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"The Original Marking Specialists"

circle No. 62 on the Reader Service Card

cised to prevent too high a rate of evaporation and with it the possibility of blistering. With infrared heating lamps any needed temperature change can be made easily and almost instantaneously.

Where oxidation of the pigment or some component of it is the basic drying method there is always a primary evaporation step which generally leaves a semi-solid film on the metal surface. The subsequent drying by oxidation may or may not be accelerated by heat.

In those cases where heat is helpful the time is generally quite long so that ovens of considerable length may be required. Here a possible advantage in the use of infrared is a lower first cost for the installation and lighter weight equipment.

Where polymerization is the mechanism of drying there is again nearly always a first step of evaporation. Following this the polymerization takes place and this process is almost always heat sensitive. Up to some point, the rate of polymerization increases with increasing temperatures, but above this point the finish will probably be ruined. This temperature is a critical characteristic of each finish. In some special cases polymerization takes place most rapidly when the temperature is varied during the drying cycle.

For polymerization drying, therefore, infrared heating with its flexibility and ability to put the heat where it will do the most good is finding wide spread acceptance.

Time factor favors the use of infrared frequently because of the rapid temperature response. No time is lost in bringing the oven up to temperature, nor in adjusting temperatures for differing treatment of finishes having varied temperature requirements.

This process allows very low or very high rates of air flow past the work, as may be desired, without affecting the actual temperature of the work.

From finishing hand tools . . .

to sanding forged aluminum

Armour Backstand Belts do the job right

For the thousand-and-one jobs the backstand belt can do easily and profitably, for the other thousands of jobs coated abrasives do so well, Armour has the answer—there's an Armour coated abrasive to do *your* job right.

Toledo Steel Tube Co. saves time

2 hours per operation per day—that's the time the Toledo Tube Co. saved by switching to backstand belts. In removing burrs and grip marks from tubing, they found Armour Coated Abrasives cut faster, last longer, give a better finish.

Armour has one of the most modern plants in the coated abrasives industry. Belts are only one of the many forms of coated abrasives available to you — more than 30,000 different varieties in grip size, backing, etc. Sheets, rolls, discs, tubes — and specialty sizes to meet your specifications, if you need them.

Conserve your stocks of coated abrasives. Write for our free booklet on "How to Store Coated Abrasives."

We recommend buying through your industrial distributor

ARMOUR *Coated Abrasives Division*

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FREE

ASK FOR BOOKLET No. D-1

IF YOU PRODUCE PARTS THAT REQUIRE FINISHING OF ANY KIND

This 22-page booklet is guaranteed to open your eyes! It gives you the inside story of advanced barrel finishing as never told before!

In the last five years, barrel finishing has made rapid advances. Only those directly connected have been able to keep up. Only 30% of the nation's manufacturers are benefiting from the tremendous cost savings and improved finishes made possible by these advances.

Now is the time to investigate this labor-saving, cost-cutting method. ALMCO barrel finishing equipment has completely paid for itself in as little as two months! This is easy to understand. A single unit installation replaces from two to twelve men. Savings run as high as 95%.

"Advance Barrel Finishing" is the only mass deburring, grinding and finishing method where results are controlled. Amazing results are now possible on almost all types of parts from large castings to small intricate parts. Close tolerance parts can be finished with absolute uniformity to almost any desired micro-inch reading.

WRITE TODAY FOR YOUR FREE COPY

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS

ALBERT LEA, MINNESOTA

PROMOTIONS AND APPOINTMENTS

Alan R. Burman as vice-president and member of the board of directors of the **Cro-Plate Company,** manufacturers of wet blasting and hard chrome plating equipment.

C. H. Webb to sales manager of **Alkali Products Division, Detrex Coporation,** manufacturers of alkaline and emulsion cleaning materials.

James R. Meade to sales engineer for **Advance Pressure Castings, Inc.,** producers of die castings in zinc and aluminum, with territory in the East.

L. A. Roe as director of the mining and metallurgical section of the **Bjorksten Research Laboratories, Inc.**

Bernard C. Case as manager of electrochemical development for the **Hanson-Van Winkle-Munning Company.**

Several moves have been announced by **Westinghouse Electric Corporation** in connection with the creation of a defense products department. *L. E. Osborne* has been appointed executive vice-president, defense products, and *W. R. Anderson* will be his assistant. *R. C. Bergvall* takes over as manager of engineering, *B. M. Brown* as sales manager and *M. A. Dotterer* as manager of production, all in the defense products department. In allied moves, *Tom Turner* assumes Mr. Osborne's duties as vice-president in charge of manufacturing in addition to his duties as vice-president in charge of labor relations and *Frank L. Snyder* becomes manager of the Aviation Gas Turbine Division.

Richard L. Farr to the newly created post of personnel administrator of **The Yale & Towne Manufacturing Company.**

Norman Bragar Co., as Northern New Jersey representatives and *Gibson Engineering Co.* as New England representatives of **Taco West Corp.** of Chicago, industrial control instrument manufacturers.

For further information circle No. 63 on the Reader Service Card

PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail — no postage is required.

PROCESSES

Recommended Design Procedure for Powder Parts: No. 145

Suggestions to help the designer of powder metal parts are contained in a folder available from American Sintered Alloys, Inc. A series of design recommendations cover such topics as tolerances, part proportions, wall thickness, draft, chamfers, relief, ribs, bosses, etc. Also included is a chart of metal powders with data on composition, porosity, tensile strength and applications. Production methods are also covered.

Gray Iron Castings by Permanent Mold: No. 146

The advantages of the permanent mold process for producing gray iron castings are emphasized in an illustrated booklet, "A Quick Picture of the Eaton Permanent Mold Process for Producing Gray Iron Castings," offered by the Eaton Mfg. Co.

Case Histories of Some Difficult Parts by Investment Casting: No. 147

Investment casting of small, close tolerance parts are the stock in trade of the Jelrus Co. Some of the more complicated of these are covered in a 4-page illustrated brochure available from Jelrus.

From Metal Powder to Finished Parts: No. 148

In a thorough review of the powder metallurgy process, contained in a 60-page spiral-bound notebook, National Molded Products, Inc., touches on the blending of powders, briquetting, sintering, sizing, oiling and machining. A section is devoted to design factors, and a complete catalog of plain, cylindrical and flanged bearings completes the subject matter.

Job Studies in Investment Casting: No. 149

Factors affecting the design and production of investment castings can be learned from the Job Study brochure available from Ohio Precision Castings, Inc., of Dayton, Ohio.

Facts on Magnesium, Aluminum and Bronze Castings: No. 150

The "Book of Facts" available now from Eclipse-Pioneer Division of Bendix Aviation Corp. is a worthwhile reference piece for engineers planning to use magnesium, aluminum or bronze castings.

Basic Design Considerations: No. 151

Such design problems as ways to avoid localized stresses are competently analyzed in a 72-page booklet which compares good and bad features of design. Booklet also goes into selection of steel from the viewpoint of the design engineer, rather than the metallurgist. It has been prepared and published by Climax Molybdenum Co. under the title, "3 Keys to Satisfaction."

MATERIALS AND EQUIPMENT

Milling Machine for Die Casting Dies: No. 155

A new tool and die milling machine manufactured by The Cincinnati Milling Machine Co., is the subject of a new catalog No. M-1731. This 8" x 18" tool and die miller is designed especially for production of die casting dies, plastic molds, glass molds, etc.

Welding Rod for Zinc and Aluminum Alloys: No. 156

Instructions for welding die cast zinc and for brazing aluminum alloys with A-Lum-Ite acetylene rod are contained in a data-filled leaflet from United Welding Service Co. The leaflet not only contains a review of physical properties of A-Lum-Ite, but also suggests a list of working rules.

Producing Dry Dissociated Ammonia: No. 157

Dissociated ammonia which is a dry, oxygen-free mixture containing 75 percent hydrogen and 25 percent nitrogen by volume is produced in horizontal cracking chamber-equipped ammonia dissociators described in a 4-page illustrated folder from Sargeant & Wilbur, Inc.

The Story of Aluminum: No. 158

Aluminum, from mine to finished product, is the subject matter covered by a 100-page booklet, "The A-B-C's of Aluminum," published by Reynolds Metals Co. Pictorial outline of fabricating processes is included.

Photoelectric Device for Protection against Flame Failure: No. 159

By means of a photoelectric cell which "sees" the flame and instantly cuts off the fuel supply when flame failure occurs, a new type of safety device has been introduced by Combustion Control Corp. The Fireye flame failure safeguard system is described in Bulletin CP 511.

Alternate Stainless Steels: No. 160

"A Guide to Type 430 Stainless Steels as Alternates of the 18-8 Series," is a 12-page bulletin from Republic Steel Corp. pointing out the comparative performance and physical characteristics. The Type 430 stainless contains no nickel.

Relationship of Cutting Fluid to Machining Efficiency: No. 161

In a new 32-page book compiled by the staff of E. F. Houghton & Co. entitled, "Getting Down to Cases on Metal Cutting," a collection of authoritative case histories are analyzed showing the application of Houghton's Antisep All-Purpose Base which is claimed to be suitable for 90 percent of all machining operations. Case histories include such details as actual machine feeds and speeds, types of machines, grades of steel and dilutions of cutting fluid.

How To Select Tool Steel for Molds and Dies: No. 162

Booklet 271 from Bethlehem Steel Co. tells how to select the right tool steel for hobbed molds, machine cut molds or master hobs.

Selector Chart for Induction Heating and Melting: No. 163

A selector chart for induction heating and melting is featured in a bulletin from Ajax Electrothermic Corp., along with a table giving heating and melting speeds for standard induction equipment.

Dimension-Finder for Screws: No. 164

A slide-type dimension finder from Parker-Kalon Corp. shows all dimensions for cold forged socket head cap screws, socket

CUT SPRAY PAINTING COT on many defense items

such as the shells and rocket bombs illustrated, by sharply increasing production through the use of

ELECTRO-FORMED METAL MASKS

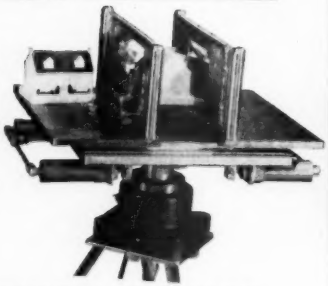
(MADE BY PATENTED PROCESS)

designed to fit into your conveyorized equipment.

We also design, engineer and build

COMPLETE AUTOMATIC SPRAY EQUIPMENT

(With or Without Masks)



MASK WASHING EQUIPMENT and AIR-OPERATED CLAMPS, FIXTURES AND TOOLS for

positioning parts in masks while painting or holding parts in place for other operations, such as welding.

Plug-type masks for keeping depressed areas clear, while spraying background; lip-type masks for protecting the background while painting depressed areas; and block cutout plane surface type masks.

Clean, sharply defined letters and decorative effects are obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas with no fogged edges. After-wiping or buffing off of overspray is unnecessary. The "loose" inside of letters and numerals, such as "O" and "6", is held in position by arched bridging to eliminate objectionable "ties."

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CONFORMING MATRIX CORPORATION

346 Toledo Factories Building **Toledo 2, Ohio**

Please send, without obligation, details on ( ) Hand masks; ( ) Mechanical masking fixtures; ( ) Air-operated masking fixtures; ( ) Stationary automatic spray painting masking machines; ( ) Rotary table automatic spray painting masking machines; ( ) Quotation on masks for parts (or prints) which I am forwarding.

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CITY & STATE .....

For additional information circle No. 66 on the Reader Service Card

set screws, flat head socket cap screws and socket head stripper bolts. Information on the device includes threads per inch, tap drill sizes, and a tabulation of sizes for set screw points and socket pipe plugs.

Standard Parts for Die Casting Dies: No. 165

Diagrams, complete with dimensions and specifications, showing a line of standard items for use in building die casting dies is available from Detroit Mold Engineering Co.

Care and Maintenance of Dies & Punches for Powder Metallurgy: No. 166

Punches and dies are among the smallest parts of any powder compressing machine, yet if they are not in perfect condition, an imperfect scrap product results. A new bulletin, "How to Save Money on Punches and Dies," from the F. J. Stokes Machine Company, has separate sections on: regular care, handling, mechanical contact, cleaning, storage, what to do about wear, lubrication in service and overloading. Text also includes a list of Do's and Don'ts for handling rotary or single punches and dies.

Wall Chart of Mills & Countersinks: No. 167

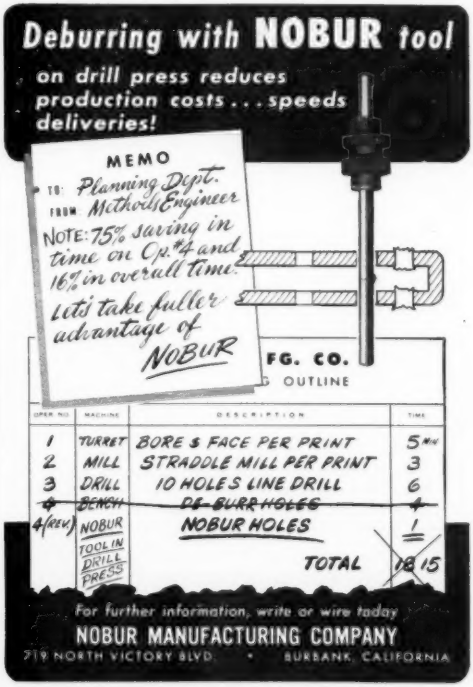
A 14" x 24" wall chart, tinned top and bottom suitable for posting in office or shop, is available from Severance Tool Industries, showing their line of midget mills, carbo-mills, chatterless countersinks and other ground-from-the-solid cutting tools.

Hydraulic Cylinder to Step Up Die Casting Injection Rate: No. 168

Illustrated among many types of hydraulic cylinder installations in a new leaflet "Use a Cylinder and Save a Man," is a 12" diameter x 8 " stroke cylinder used to inject molten

Deburring with NOBUR tool

on drill press reduces production costs . . . speeds deliveries!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4(new) | NOBUR TOOL IN DRILL PRESS | NOBUR HOLES | 1
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For additional information circle No. 73 on the Reader Service Card

metal into a die casting die. Increased production and improved castings are reported by Ledeen Mfg. Co. who have issued the publication, Bulletin 152.

Manufacturer of Die Casting Dies & Plastic Molds: **No. 169**
A folder from The Parker Stamp Works, Inc., describes the company's services and facilities for manufacturing die casting dies and plastic molds.

FINISHING

Engineering Data on Screw or Bolt and Washer Assemblies: **No. 172**
With time study comparisons, specification drawings, tabular charts and production photographs, Eaton Manufacturing Co. has presented the case of pre-assembled screws or bolts and washers, in their Engineering Folder S-49. This 40-page book with plastic binding gives complete reference data on the line of Springtites and Sems.

Identifying and Selecting Abrasive Grains & Powders: **No. 173**
A complete guide to the identification and selection of abrasive grains and powders used for metal finishing is contained in a new book published by The Carborundum Company.

Production Drilling of Small Holes: **No. 174**
A super-sensitive, variable speed drilling machine designed for the degree of precision demanded in the manufacture of cameras, clocks, business machines and similar assemblies, is the subject of a folder from the Hamilton Tool Co. The Varimatic drilling machine has two speed ranges, low from 840-2700 rpm, and high from 2900-9300 rpm obtained by 2-step drive and spindle pulleys.

Zinc Plate with Additive Stands 200 Hr. Salt Spray: **No. 175**
Using a Promat additive C-42 in zinc plating bath, followed by a simple secondary dip, a zinc plate is reported to withstand 200 hours in salt spray without white corrosion or red rust. Report on Promat products for improved zinc plating are included in a folder issued by Promat Div., Poor & Co.

Complete Line of Air Tools and Accessories: **No. 176**
In a new 76-page catalog, the largest ever published by the Aro Equipment Corp., the complete line of Aro industrial air tools and accessories is presented. The tools are grouped in sections, such as grinders, screwdrivers, drills, etc.

How to Plate on Aluminum: **No. 177**
A simple method for plating on aluminum is reported upon in a technical data sheet from Enthone, Inc., describing its Alumon process. The process, suitable for still or barrel plating, permits nickel or chromium plating of either cast or wrought aluminum alloys.

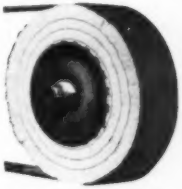
Use of Bearing Balls for Barrel Finishing: **No. 178**
A large portion of the new brochure from The Abbott Ball Co. on "Bearing Balls and Burnishing Materials" is devoted to practical barrel finishing. Specific production information relating to barrel speeds, volume of materials, types of additives, and recommended shop practice is included.

Buffing Compounds That Spare the Nickel: **No. 179**
Special buffing compounds reported to give a bright finish without buffing off precious nickel are included in a catalog on polishing and buffing compounds, buffs and platers' supplies from Schaffner Manufacturing Co.

Free Sample of Tap and Drill Lubricant: **No. 180**
From Tap & Drill E-Z Corp. comes an announcement of Lubri-Cut, a special cooling and lubricating agent that is said to triple production output and increase the life of taps and cutting tools. Free samples of the patented compound are offered, along with complete information on its use.

Your best bet's
FORMAX

for
ZIPPO BUFFS
These famous long-wearing buffs run cool under all buffing conditions. Constructed of high count bias-cut cloth mounted on safe steel centers. Available in a wide range of densities and center diameters.



for
STYLE C-20 CONTACT WHEELS and F-26 Belt Lubricant
A C-20 flexible Contact Wheel will form itself to the shape of the work and permit the abrasive belt to polish contoured surfaces and F-26 Abrasive Belt Lubricant will increase belt life by preventing loading and glazing. Produces finer, smoother and brighter surfaces through lubrication.

for
BUFFING COMPOUNDS
A complete line of production buffing compounds. Produced in bar and tube form. Formax is the originator of the "Spraymax" Liquid Compounds for brush or spray application.

for
FLEX-A-GLU POLISHING WHEEL CEMENT—A flexible synthetic adhesive in a ready-to-use form. Dries quickly. Increases polishing wheel life and produces uniform finishes regardless of grit size used.

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3171 Bellevue Ave. DETROIT 7, MICH.

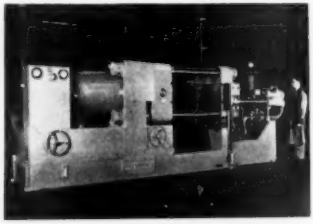
MANUFACTURED IN CANADA BY JOHN CALLOWAY LTD., KITCHENER, ONT.
For additional information circle No. 68 on the Reader Service Card

PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail — no postage is required.

INCREASED INJECTION SPEED FOR DIE CASTING MACHINE

H-P-M Model 400-AB Die Casting Machine with Nitrogen Accumulator, The Hydraulic Press Mfg. Co.



SPECIAL FEATURES: All-hydraulic design. Injection speeds up to 400 fpm are now available. Injection pressure build-up is instantaneous and positive, there is no pre-fill valve to close. Maximum injection pressure achieved when die is filled, with no drop off of pressure, resulting in castings relatively free of porosity. Plenty of space around die mounting surfaces for installation of core pull cylinders. Equipped with a dual hydro-electric safety device which guards against premature injection.

SPECIFICATIONS: Accumulator bottle, filled with nitrogen, is connected directly to the double acting hydraulic injection cylinder. Hydraulic fluid under pressure from the variable displacement pump forces the injection ram backward, compressing the nitrogen gas into the bottle. Hydaulic pressure from the pump holds the injection ram retracted until the operator is ready to inject the hot metal into the die. By-passing the hydraulic fluid from the pump and releasing the fluid in the forward end of the injection cylinder allows the expanding nitrogen gas to force the injection ram forward at a rapid rate. Speed of plunger advance is regulated by controlling the flow of hydraulic fluid from the forward end of the injection cylinder, ram advancing as fast as the fluid is released.

For additional information circle No. 105 on the Reader Service Card

LACQUER FOR PROTECTING METALS AGAINST CORROSION

BO 562

United Lacquer Manufacturing Corporation

SPECIAL FEATURES: A clear synthetic lacquer that provides non-ferrous metal objects with lasting protection against corrosion. Is applied in a hair-thin coating which preserves an original plated metal effect. May be applied to brass, bronze, aluminum, platinum, copper and other non-ferrous metals by brush, dip or spray methods. Dries dust free within a few moments and may be handled within approximately 10 minutes.

SPECIFICATIONS: Provides unusual hardness offering high resistance to tarnishing caused by corrosive elements in the atmosphere and alkalis. Available in gloss, semi-gloss and flat.

For additional information circle No. 106 on the Reader Service Card

CHECKING DIE CASTING DIE TEMPERATURE

Model 310 Surface Temperature Thermometer

Pacific Transducer Co.

SPECIAL FEATURES: Surface thermometer for checking outside temperature of die casting dies, electric motors, cylinder blocks, journals and other bearings, etc. Affixed to flat surface by applying a small amount of silicone grease, which is supplied with the instrument, and sticking the thermometer in place. The grease does not melt and so holds the instrument throughout all ranges of temperature, providing thermal coupling between the surface to be measured and the instrument. Also furnished with thermometer is small magnetic clamp to hold it securely in place when applying it on steel dies or other ferrous surfaces.

SPECIFICATIONS: Thermodynamically designed to produce an essentially unilateral thermal instrument which indicates the temperature from the back of the instrument only. A highly reflective evaporated mirror on the dial insures the thermal element against external radiation. Range is 0 to 300 F calibrated in 2 degree increments. Thermometer is 2" in diameter and weighs one ounce.

For additional information circle No. 107 on the Reader Service Card

LUBRICANT-COOLANT FOR METAL CUTTING OPERATIONS

Cool-O-Lube

Air Conversion Research Corporation

SPECIAL FEATURES: Lubricates and dissipates heat in all metal cutting operations. Effectiveness of the solution carried by the compressed air stream is claimed to be many times greater than free flowing coolants applied by conventional methods. Solution is non-injurious to health of machine operators, it has no odor, gives no smoke, is non-rancid and non-rusting. Is claimed to have high film strength, super oiliness, low viscosity and to remove with water.

SPECIFICATIONS: Sold as a concentrate and is basically diluted 1 part solution to 9 parts water. Claimed to absorb 2½ times more heat than oil.

For additional information circle No. 108 on the Reader Service Card

ACCORDIAN TYPE WAY PROTECTOR FOR MILLING MACHINES

Milling Machine Way Protector

A & A Mfg. Co.

SPECIAL FEATURES: Accordion type way protector for milling machines designed to prevent chips, dirt and abrasives from scoring, scratching, grooving and cutting the ways. Protector mounted permanently and folds automatically as work bed is moved in either direction.

SPECIFICATIONS: A way 20 feet long requires 24-inch mounting space on end of upper bed. Fabricated of du Pont Fairprene. Claimed to be impervicus to oil, grease, dirt and abrasives.

For additional information circle No. 109 on the Reader Service Card

HEAT RESISTANT ALUMINUM PAINT

Heat-Rem H-170

Speco, Inc.

SPECIAL FEATURES: Extra high heat resistant aluminum paint which has been improved to permit air drying in 30 minutes. Claimed to withstand temperatures to 1700 F.

SPECIFICATIONS: Produced from a silicone base, fuses with surface metal to form bright, elastic finish resistant to moisture, corrosion, mild acids, alkalis and industrial fumes.

For additional information circle No. 110 on the Reader Service Card

BENCH MODEL WET-BLASTING UNIT

Pressure-Blast, Jr.
The Cro-Plate Company, Inc.

SPECIAL FEATURES: Used for deburring, descaling and general surface cleaning. Replaces the conventional pump function with the siphoning action of a compressed air operated jet gun.

SPECIFICATIONS: Of stainless steel construction with sweat copper plumbing. Uses any abrasive from 75 to 5000 mesh. Easily installed, requiring only a ⅜" water connection, a ⅜" air connection and a single 110 volt line for blower operation and lighting.

For additional information circle No. 111 on the Reader Service Card

GRANITE SURFACE PLATE FINISHED TO 5 MILLIONTHS

Auto-Collimator
Collins Microflat Company

SPECIAL FEATURES: Development of granite surface plates 48" x 120" has been announced by The Collins Microflat Company. These are the largest the company has produced. To turn out a surface of such giant area means of lapping and checking the surface had to be developed. By adopting the auto-collimator, readings of surface accuracy now can be obtained to within five millionths of an inch.

SPECIFICATIONS: Function of auto-collimator depends on the principle that a beam of light reflected by a mirror is deflected if the mirror is tilted and the angle through which the reflected beam is turned is twice the angle of tilt of the mirror. A light beam reflected microscopically reveals the most minute inaccuracy, so that the worker can determine what surfaces to lower with the end result of scientifically producing a flat area of greatest accuracy throughout the 48" x 120" surface.

For additional information circle No. 112 on the Reader Service Card

OPTICAL HARDNESS TESTER

Officine Galileo Universal Hardness Tester
Metallurgical Instrument Co.

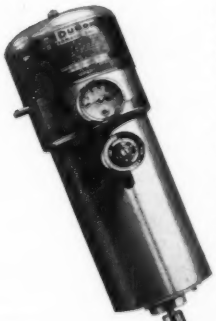
SPECIAL FEATURES: Especially designed for Rockwell and Brinell hardness tests. Can be adapted to special tests and Vickers measurements. Gives hardness measurements following the Rockwell on any type metal in the Rockwell A through F scales by direct reading. Operation is simple and readings easy to take. Tester makes use of a lever arm supported on knife edges and projects a magnified image of the hardness reading on a screen. This "optical balance" maintains its calibration over extended time intervals and is claimed to be highly accurate.

SPECIFICATIONS: Loads are interchanged automatically by patented device which is controlled by an external knob. All loads are obtained by weights which insure absolute constancy of calibration. A built-in oil damper regulates the speed with which the load is applied. An external screw adjusts the speed.

For additional information circle No. 113 on the Reader Service Card

GET DUMORE

the drill head with automatic built-in controls



- **New Resistance Drilling**—Workpiece material governs feed and speed rate.
- **Self-Contained Air** — Simply plug into electric outlet. Built-in air compressor feeds drill at proper rate.
- **Air Pressure Regulator** — (0 to 15 psi.) Operator sets to compensate for drill size and workpiece material.
- **Adjustable Stroke Control**—Stop nuts control drilling depth from 1/32" to 1-1/8" (.004" accuracy).
- **Automatic Chip Clearance** — Depth staging eliminates chip clogging.

Get the information on this revolutionary tool. See how it stops operator guesswork, provides flexible setup. Combines big cost reductions with low price tag. Write for bulletin.

THE DUMORE COMPANY
1317 17th ST. • RACINE, WIS.

and get all these cost reducing benefits

Motor manufacturer doubled output, decreased drill breakage.

Labor costs on bronze nozzle holders slashed $75 on first run.

Sound equipment manufacturer cashed in on big savings.

For additional information circle No. 67 on the Reader Service Card

Oakite's New FREE Booklet on Paint Stripping

WHAT'S THE BEST WAY TO STRIP PAINT FROM METAL PARTS TOO LARGE TO BE SOAKED IN TANKS? See Page 3

answers many questions that will lead you to better stripping procedures. You'll want to read more about:

What's the best way to strip large areas of structural metal where a steam supply is available? *See page 5.*

What's best when steam is not available? *See page 7.*

What is the cheapest way to strip metal parts in large volume? *See page 9.*

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

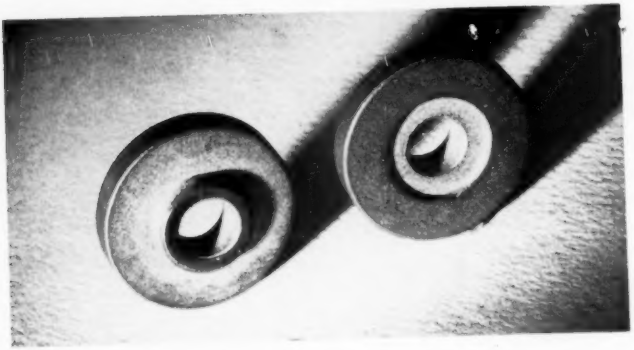
FREE For a copy of "How to STRIP PAINT" write Oakite Products, Inc., 34G Thames Street, New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

For further information circle No. 70 on the Reader Service Card

Powder Metal Parts Like These...



SAVE MONEY... MAINTAIN PRODUCTION

Shown above are powdered iron rollers which are used in file cabinets. Steel ball bearings were formerly used. Not only has the porous iron bearing provided a quieter, freer moving drawer but the price of this part is considerably lower than a ball bearing. International Power Metallurgy Co. would like to help you with your powder metal design problems.

THE POWDER METALLURGY ENGINEERS HANDBOOK IS AVAILABLE TO YOU. SEND FOR A COPY ON YOUR COMPANY'S LETTERHEAD.

International Powder Metallurgy Co.

439 W. MAIN STREET • RIDGWAY, PENNSYLVANIA

For additional information circle No. 22 on the Reader Service Card

For additional information circle No. 4 on the Reader Service Card

continued from page 25

cause an artificial shortage.

Is there enough press and sintering capacity to handle more production?

In considering replacing any other metal with powdered iron, another point should be constantly in mind. The present defense effort is placing a strain on men and machines as well as on critical materials. By conversion to parts fabricated from metal powders, the load now carried by machine tools can be materially reduced.

There is, today, an excess of powder pressing and sintering capacity in this country, so that the powder metallurgy industry can absorb a greatly increased load without having to increase its present facilities.

Andrew Langhammer, chairman of the powder metallurgy committee of American Ordnance Association, estimates the press capacity of the country at 100 million pieces per month. It is probable that long before this capacity is over-taxed, any needed additional press facilities could be installed.

In considering any change to parts made from iron powder, care should be exercised that those powder mixtures containing an appreciable amount of copper be avoided. The present trend, particularly in structural parts, is to use a powder mixture containing up to 30 percent copper. Since copper in all forms is under control it will be necessary to avoid its use in the mix.

The physical properties obtainable with an iron-copper mixture can be secured with a straight iron powder but requires different processing. Probably the cost of pure iron parts will be a little higher than when an iron-copper mixture is used, but there are many cases in which the use of iron powder parts, even at a slightly

increased cost, would permit continuation of production that would have to halt if present methods and materials were not modified.

What parts can be made from iron powder?

Another problem which has caused some trouble in the application of iron powder parts is surface finishing. Several successful processes have been developed for forming a black iron finish in iron powder parts. Under some conditions iron parts can be chromium plated though only high capacity density or surface burnished parts respond properly. Powder parts respond readily to all types of paint and lacquer finishing and are especially adaptable as inserts in molded plastic parts.

Earlier, mention was made that in considering a change to iron powder for fabricating any parts, the designer should consult the engineers of the powder fabricating companies. This point cannot be emphasized too strongly.

There are multitudes of cases where direct conversion cannot be made but where minor redesign will allow the part to be fabricated from iron powder. The average engineer cannot be expected to know all of these "tricks of the trade" and should not reject powder metallurgy as a fabricating method until he has been assured by the men with the know-how that a part cannot be made from iron powder.

The machining of parts made from metal powders is highly feasible. Literally thousands of parts are partially fabricated every day out of iron powders and then a small amount of finish machining done on them. This generally results in getting the part at a materially lowered cost and at a much lower machine loading.

New techniques for machining will have to be learned, but the information is available from the fabricators. Many of the contract shops have machine tools set up for the expressed purpose of doing the final machining necessary after they have pressed and sintered the partially finished piece.

Inspection costs are also decreased when a part is fabricated by an outside powder metallurgical processor. All parts must pass the vendor's inspection before delivery and, in the case of completely finished parts, all rejects have already been culled out.

ZINC OUTPUT DIPS

Mine production of recoverable zinc in the United States in September was 49,991 short tons, a decline of 8 percent from the 54,403 tons produced in August.

J. E. DRAPEAU SUCCEEDS E. H. KELTON AS STANDARDS CHAIRMAN

J. E. Drapeau, Jr. of the Glidden Company has been elected chairman of the Standards committee of the Metal Powder Association. Mr. Drapeau succeeds E. H. Kelton of the New Jersey Zinc Company who tendered his resignation after three years service due to a change of duties with New Jersey Zinc.

Does YOUR Product Require Parts Like These?
If so, are you interested in—
★ LONGER LIFE?
★ SPEEDIER PRODUCTION?
★ LOWER COST?
★ IMPROVED APPEARANCE?
★ LIGHTER WEIGHT?

The wide diversity in metal powder parts (as shown here) which can be made through the varied processes of Powder Metallurgy are filling many increasing applications. It is no mere coincidence that the largest molders of powdered metal parts look to MD as their source of supply for all kinds of metal powders. MD will be glad to place at your disposal, the full benefit of its 35 years of experience in the Metal Powder industry and to recommend qualified molders for your requirements.

METALS DISINTEGRATING COMPANY, INC.
Elizabeth 8 • New Jersey
Plants: Elizabeth, N. J., Manchester, N. H., Berkeley, Calif., Emeryville, Calif.
SUBSIDIARY OF AMERICAN-MARIETTA COMPANY

1884 MD Since 1916

METAL POWDERS
METAL PIGMENTS
METAL ABRASIVES

WORLD'S LARGEST MANUFACTURER OF FINELY DIVIDED METALS

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IMPOSSIBLE? Don't say it until you try our Investment Casting Process

**We cast ALL metals . . .
into ANY shape . . . .
to EXACT specifications**

High standards of accuracy and finish are always assured. Moreover, the chemicast process is very economical and with our greatly increased capacity, orders are completed rapidly.

Send us a print, together with specifications and pertinent data . . . price and delivery quotations will be sent promptly.

PRECISION CHEMICAST CASTINGS

CHEMICAST DIVISION
WHIP-MIX CORPORATION

411 WEST AVERY AVE. • LOUISVILLE 8, KENTUCKY

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ZINC and ALUMINUM
DIE CASTINGS

• The largest and most modern equipped die casting plant in the New England States.

Chas. W. Onse
President

THE NE NEW ENGLAND DIE CASTING CO.
445 FRONT AVENUE • WEST HAVEN, CONN.

For additional information circle No. 36 on the Reader Service Card

POWER PACKAGE
continued from page 34

this part, therefore, Indian uses another semi-permanent mold aluminum alloy casting.

Both bronze bushings and roller bearings are used as inserts in this part and all of them are applied by the cooling process mentioned above.

The center section of the three piece transmission case is an aluminum die casting. This part as well as the crank case section just described are not polished, but are machined as is Indian's usual practice to give the required fits.

Brake lining is bonded to die cast aluminum brake shoes

The brakes on the Indian Motorcycle are cam actuated internal expanding brakes. The shoes are aluminum die castings with steel plates cast integrally with the die casting to act as wearing surfaces where the shoes

RACINE

ZINC OR ALUMINUM
die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.

Inquiries Invited
Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.

RACINE DIE CASTING CO.
1500 16TH ST., RACINE, WIS.

circle No. 42 on the Reader Service Card

pivot on a steel bearing pin. The brake lining is bonded to the shoes with a thermo-setting plastic cement.

The plate on which the shoes are mounted is another die casting. This plate serves the dual function of furnishing a support for the brake shoes and acting as a cover plate for the brakes. Since one surface of it is exposed, that surface is polished by buffing to give a highly reflective surface.

In everything that has been written above, no mention has been made of shop tolerances to which all parts are machined. Generally speaking, all machined surfaces are held to within ± 0.001. About the only departure from this general tolerance is on those parts where an even smaller dimensional variation is allowed.

The question of cost reduction which is often one of the deciding factors in converting to die castings does not enter into this picture as strongly as in other cases. While it is known that many of the die castings show a marked cost reduction over their counterparts made by some other method, the controlling factor in Indian's choice of die castings and permanent mold castings was weight reduction. The design of the motorcycles was almost entirely new and the entire machine was developed with the thought in mind of using aluminum wherever possible.

Some other engine components are also die castings such as the carburetor housing and the magneto housing, but these are purchased as complete units so that for these parts, the use of die castings was not dictated by Indian designers.

LETTERS TO THE EDITOR
continued from page 6

identified by the term "semi-permanent mold casting."

It is practical sometimes to core undercuts in die castings, but this can only be done with so-called knockout cores which must be placed in the die by hand before each injection of metal, and knocked out of the casting after it has been removed from the die. This is quite expensive because it slows the operation, and usually requires several sets of cores so that it is not necessary to wait for the knockout before placing cores for the subsequent casting cycle. One of the best examples of this type of coring is a type of vacuum cleaner housing in which the blower enclosure is formed by as many as seven knockout cores.

An outstanding use of sand cores with permanent mold casting is covered in the article on Indian Motorcycles in this issue.—Ed.

REED-PRENTICE CORP. OPENS DETROIT OFFICE

Reed-Prentice Corporation of Worcester, Massachusetts has opened a new branch sales office at 2842 West Grand Blvd., Detroit, Michigan. Manager of the office is Iver J. Freeman who has served in a like capacity in the company's Los Angeles office. Reed-Prentice manufactures machine tools, die casting machines and plastic injection molding presses.

Large or Small...
SIMPLE OR COMPLEX
• Accurate can supply you with precision die castings when, how and where you need them. May we help you with yours?
Write today for complete service
Aluminum, Zinc, Magnesium Alloy Die Castings
ACCURATE DIE CASTING CO.
3089 E. 80TH STREET
CLEVELAND 4, OHIO
Circle 1 on Reader Service Card

PMM INDUSTRY NEWS

KAISER BOOST OUTPUT

An agreement with the Kaiser Aluminum and Chemical Co. to expand its facilities at Chalmette, La., to produce an additional 100,000 tons of aluminum for stockpiling and other defense needs has been announced by the General Service Administration.

HPM MOVES CHICAGO OFFICE

Hydraulic Press Mfg. Company has announced that the new address for their Chicago office is 3058 Peterson Building, Peterson Avenue, Chicago, Illinois. Don C. Youngblood, district manager, will continue in charge of the office which was formerly located at 201 North Wells Street.

Aluminum and Zinc Base
DIE CASTINGS

PARAGON die castings are everything the name implies. Four offices are ready to serve you.

Our plant contains every modern facility to produce die castings which leave nothing to be desired in workmanship, accuracy, appearance and function.

Inquiries are invited. Send blueprints or sketches for quotation.

STRENGTH
PRECISION
UNIFORMITY
ECONOMY
COMPLEXITY

QUALITY PARAGON CAST DIE CASTINGS

PARAGON Die Casting Company
5853 WEST DICKENS AVE. • CHICAGO 39, ILL.
SALES OFFICES: DETROIT • INDIANAPOLIS • CHICAGO • MILWAUKEE

For additional information circle No. 38 on the Reader Service Card

ADVANCE TOOL NAMES NEW SALES MANAGER

E. F. Miller

E. F. Miller has been appointed sales manager of the Advance Tool & Die Casting Company, it has been announced by Clarence Omann, president of the Milwaukee firm.

Mr. Miller has had 22 years experience in sales, merchandising and advertising including industrial, commercial and domestic fields. He spent 12 years with Moe-Bridges Corp. of Sheboygan as territory manager and sales manager, and 10 years with Rway Furniture of Sheboygan as branch sales manager.

Mr. Miller will direct sales, advertising and promotional programs in an enlarged overall plan of company operations.

BUYS MINING COMPANY

American Zinc, Lead & Smelting Co. of St. Louis have announced the purchase of the Nellie B. Mining Co. The Nellie B. consists of about 1360 acres in the Oklahoma section of the tri-state lead and zinc district.

BUILDS CHEMICAL LAB

Vanadium-Alloys Steel is now utilizing this new chemical laboratory in a recently completed building which is more than twice as large as the previous lab. Vanadium-Alloys has completely reequipped the department which operates on a 24 hour day basis.

OPPORTUNITIES

FOR SALE:
DIE CASTING MACHINES

1—Kux Model BA-12, space between die bars 12¼" x 12¼", with furnace and controls.
2—Kux Model BH-18, space between die bars 18¼" x 18¼", with furnace and controls, full hydraulic.
1—Kux Model BH-30, space between die bars 32½" x 17¾", with furnace and controls, full hydraulic.
1—Walker-Hooper, space between die bars 25" x 25", with furnace and controls, hydraulic.
1—Home-made, space between die bars 28" x 28", with furnace and controls, hydraulic.
2—Home-made, aluminum cold chamber, space between die bars 28" x 28", furnace and controls.
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DIE CASTING EXECUTIVE

Experienced sales engineering and management. Time study, estimating, tool design and production. Desires new connection, preferably Ohio or Michigan, but opportunity more important than location.
Age 39, married. Willing to accept moderate salary until worth proven. Please reply to Precision Metal Molding Box 1231.

SALES REPRESENTATIVE:

now handling die casting sales in the Central area, working out of Cleveland, Ohio, wishes to represent a powder metal fabricator in addition to his present account. Many years experience selling metal parts. Write to Precision Metal Molding Magazine, Box 1151.

ADVERTISERS' LITERATURE
Continued from page 8

No. 68. BUFFS, BUFFING COMPOUNDS AND POLISHING MATERIALS are listed in the Formax Co. catalog.

No. 69. BARREL FINISHING BY THE 3M METHOD is described in a catalog issued by Minnesota Mining and Mfg. Co.

No. 70. PAINT STRIPPING THE EASY WAY is described by the Oakite Co. in their latest booklet.

No. 71. HYDRO-FINISHING OF DIE CASTINGS by the Pangborn Co.'s hydro-finishing system is described in a catalog.

No. 73. MACHINE DEBURRING details are available from the Nobur Mfg. Co.

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Die Castings

Preferred WHEN ONLY THE BEST IS GOOD ENOUGH

There must be a reason why so many highly discriminating manufacturers entrust *all* of their work to us. The reason is they know from experience that the finished job will meet every specification as to appearance, strength, accuracy and function. Furthermore, the price on either long or short runs is in line with their production and selling costs.

If you are located west of the Mississippi River we are in an excellent position to take care of your die casting requirements. Quotations made promptly.

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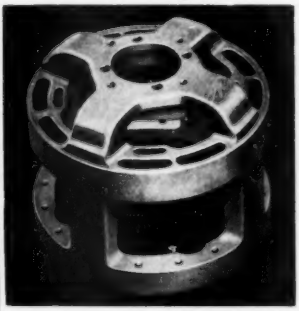
The Most Complete and Modern Die-Casting Facilities in New England



Our latest type high pressure Lester Phoenix machines insure precision low-cost castings.

You can depend upon our proven know-how to design and develop your most intricate castings.

Ask to have the Mason representative call, or send us your prints. Our Engineering department will give every request, whether large or small, conscientious prompt attention.

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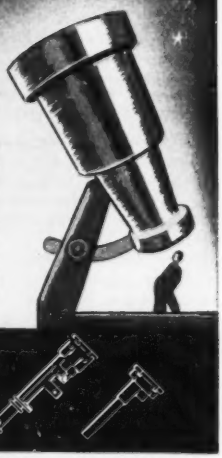
Seein' is Believin'

FORT PRECISION IS Worth looking into

Seeing is Believing and although they are rarely seen by any but mechanics, oil pump housings are a very important part of the engine of your car. "FORT" precision castings are used for this important job because they are perfectly engineered, thus are durable, light in weight and require a minimum of machining.



TRADE FORT MARK

Three types of oil pump housings made by "FORT"

FORT DIE CASTING CORP.
MARYSVILLE, MICHIGAN

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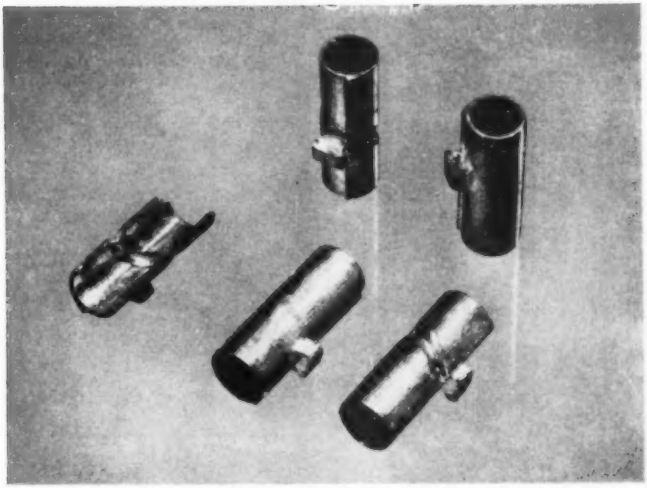
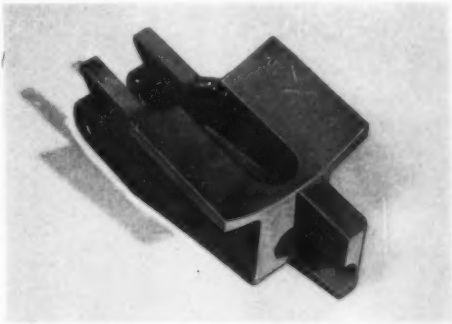
SIMPLIFIED SOLUTIONS

for production problems



INTERNAL THREADS IN THE DIE CAST NUT for a mechanical pencil are formed by casting the cylindrical shape and then stamping diagonal grooves on the outside of the barrel. This produces a thread on the inside. These segments form almost a complete thread, have no sharp edges, and mesh smoothly with the thread on the plastic feed mechanism screw. Alternative methods of obtaining a similar result would be to cast an internal thread which would require an expensive and complicated casting die, or to cast a boss on the inside of the barrel resulting in sharp corners and requiring a delicate trimming operation. Wall section of these die castings is .012 with about .002 draft. They are produced by the Small Castings Department of The Dollin Corp., Irvington, N. J. Shown above are pieces as cast, after stamping, and sawed in half to reveal the internal thread detail.

POWDER METALLURGY in the field of hardened steels has proved to be very useful for low cost manufacture of parts such as this ratchet which is part of a friction clutch used on a Multigraph duplicating machine. So-called file hard is the specification for this ratchet, but it is more probably a minimum of 65 Rockwell C. As compared with the original method of machining from bar stock, this powder metal part shows a saving of 28 percent. It is molded for Addressograph-Multigraph by Powdered Metal Products Corp. of Franklin Park, Ill.



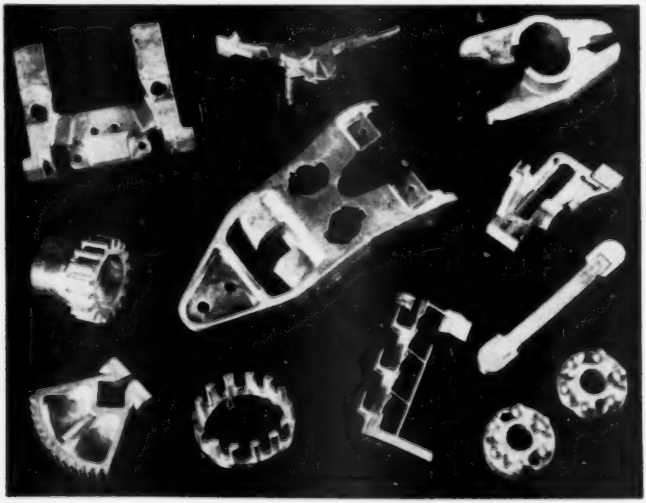
THIS PIVOT BODY for a 57 mm recoilless rifle was formerly milled from a 9-pound block of metal down to one pound of finished product. Note it is investment cast in SAE 4140 and supplied heat treated, with no metal wasted. Elimination of waste and expensive milling and tooling has resulted in a 50 percent saving. The piece is produced by Investment Casting Company, Newark, N. J.

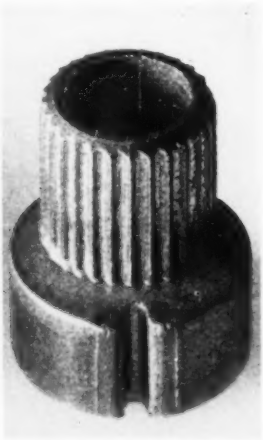
SIMPLIFIED SOLUTIONS

for production problems

MACHINED DOWN FROM A "BLANK", this quill shaft bushing for the injection pump of a diesel engine is cast in a permanent mold. All dimensions, inside and out, are machined. The permanent mold process supplies a dense, sound casting with all required physical properties at a cost below that of any comparable fabricating method. The piece is cast by the Aluminum Company of America for American Bosch Corp.

MANGANESE BRONZE offers ultimate tensile of 95,000 psi and 60,000 psi yield strength (0.5% elongation) when cast in plaster molds. A group of typical manganese bronze plaster mold castings produced by Atlantic Casting & Engineering Corp. of Clifton, N. J.

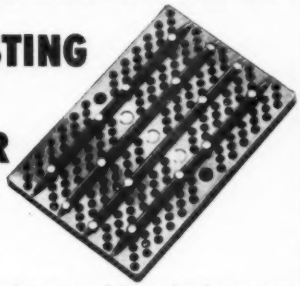




NOT LIMITED TO SIMPLE SHAPES, powder metallurgy is capable of producing combinations such as this cam and serrated shank. This part is formed in brass powder by International Powder Metallurgy, Inc., of Ridgway, Pa. It is interesting to note that the shank is situated eccentrically on the base.

IMAGINATION

DIE CASTING by YODER



Imagination saved a costly, delicate drilling operation on this adding machine part. Cast with many indentations, this precision die casting requires only a simple milling job on the reverse side to finish its 182 small holes. Perhaps you have an application where die casting can save your production operations! Call, wire, or write today!

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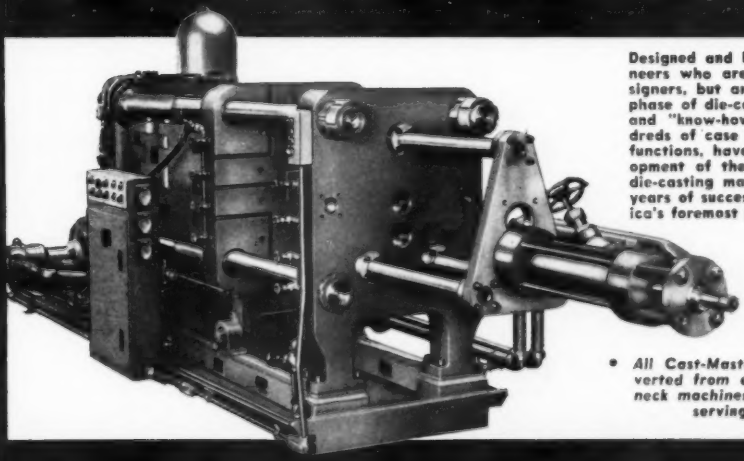

Designed and built by top-notch engineers who are not only machine designers, but are well versed in every phase of die-casting. Their knowledge and "know-how" combined with hundreds of case histories on die-casting functions, have resulted in the development of the CAST-MASTER . . . a die-casting machine with a record of years of successful operation in America's foremost plants.

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The Versatility of Lightweight Magnesium and Aluminum Die Castings Is Emphasized in Component Parts for Chain Saws

More and more manufacturers are turning to die castings made from magnesium and aluminum alloys. They are being selected because these new lightweight, yet tough, metals greatly decrease the weight of products. Also, through die casting, greater scope is offered for turning out the designers' ideas—allowing more freedom of design.

The weight factor is of utmost importance to the manufacturer of such a specialized piece of equipment as a Chain Saw. He must keep the weight of his product down—have it built light for portability—and through this weight reduction reduce worker fatigue—giving greater productivity. These lightweight metals must be tough. Leading manufacturers of chain saws are having various components, such as motor parts, covers, gas tanks, housings, handles, shrouds and fans, etc., die cast for their equipment from magnesium and aluminum alloys.

Whatever your portable tool requirements are or whatever you produce that has to be pushed, lifted or carried, you can safely depend on the versatility of these new tough lightweight metals. They are being successfully die cast by *LITE*METAL DICAST, INC., an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs—little machines for little jobs . . . the right sizes and types of the most modern die casting equipment. Our facilities are complete for producing parts from the size of a button to large cable spools.

Remember, even comparatively simple dies can be used to die cast parts at lowest cost conditions and great savings can also be made in labor formerly required for machining and finishing.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST Inc.
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PLANT AND EXECUTIVE OFFICES

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continued from page 27

The remaining aluminum parts, die cast in aluminum alloy No. 380 which contains silicon and copper, are relatively simple in shape and represent no unusual problems either in die design or casting technique. However, tolerances are held rather strictly, and on bearing bores for end bells, ordinary limits are held to less than .005 and finished to .0005.

Here again, a comparison of the die cast end bell with its green sand predecessor will be of interest. Costwise finished castings show a 56 percent lower figure when die cast. Reason for this lies largely in secondary operations which, on the sand cast end bells, included heat treating, two turret lathe operations, three multiple drill operations, plus a grinding and polishing. The die cast pieces are trimmed, tapped and tumbled, besides boring two holes that do not lie in the direction of the die motion.

The heavy duty, radial arm saws manufactured by DeWalt are intended primarily for constant professional usage which permits no compromise in choice of materials, with regard to serviceability. It has been found that not only are equivalent properties obtained by introducing permanent molded and die cast components, but in many instances, superior performance has resulted.

CUT COSTS

with expendable wax patterns and STA-WARM WAX MELTERS

By pumping melted wax into dies, expendable patterns may be made for certain applications at low cost. Greatly contributing to the favorable cost in this operation is exact control of the melted wax. Its temperature and fluidity greatly influence successful operation by reducing the percentage of rejects.

Here, Sta-Warm wax melting pots prove their outstanding value with capacities from one qt. up to any practical gallonage. Units are designed to heat various wax compositions uniformly, fast, without burning or leaving cold lumps, and heating to close temperature tolerances.

Special accessories of use to die casters are available to speed up dispensing and reduce costs of operation. Inquire today for full information, outlining your requirement.

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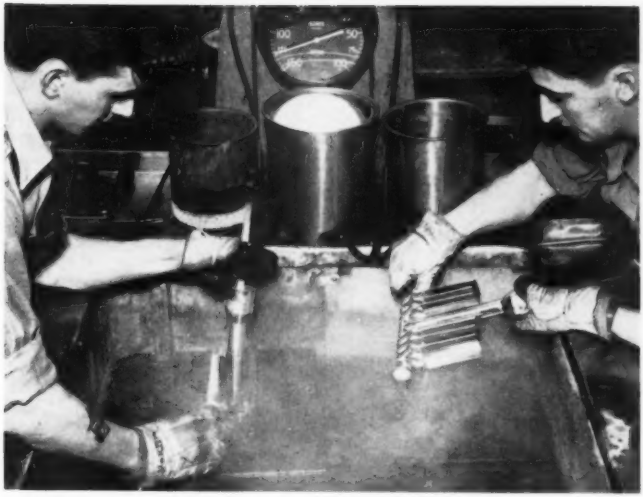


FROZEN MERCURY PATTERNS are lifted from the -125F acetone bath in which they are stored prior to dipping them in ceramic slurries to form the "investment" or mold. When this cycle is completed, the mercury is allowed to thaw and run out of the molds, leaving a precisely shaped cavity to be filled with molten metal. Photo was taken in the Tapco plant of Thompson Products, Inc., who operate under license from Mercast Corp.

INVESTMENT CASTING FROM FROZEN MERCURY PATTERNS as a means of reproducing pieces that are too intricate for other techniques

DURING the past ten years the investment casting process has rapidly been gaining favor as a fabricating method for those parts where precise duplication of surface detail, close casting tolerances, and complex cast shapes are desired.

Better known as the lost wax process, investment casting has put in the hands of the design engineer a tool that will often permit the fabrication of a single part that otherwise would require a complex assembly of forged, cast or machined sub-assemblies.

The original process involves the use of a wax or plastic pattern around which a mold or investment is cast. The pattern is then melted out, the mold baked and metal then poured into the cavity.

Within the past few years some detailed improvements have been made in the investment casting procedure. These developments, known as the Mercast process, involve the use of frozen mercury as a disposable pattern instead of wax or plastic.

First step: a tool steel die

As a first step in making a casting by the Mercast process, a die must be made of steel in which the

RANGE OF SHAPES capable of production by using frozen mercury patterns can be seen in the photo, **above**, reproduced through courtesy of the Mercast Corp., while an idea of a normal size of casting is provided by the photo, **left**, from Kolcast Industries, Inc. Investment castings between 10 and 20 pounds in weight are not unusual, while some exceptional jobs weighing 90 pounds are also reported.

mercury can be frozen.

If the design of the end product is symmetrical or simple in configuration, the master mold is simply made in two parts and, when the mercury pattern has been frozen, the halves of the mold are opened and the pattern is taken out.

However, this die need not be, and very often is not, a negative of the part to be cast and herein lies one of the advantages of the process. For a single part, a number of dies may be made each of which is only a portion of the final piece. As will be described later, the components may be welded together to form the desired shape. Generally, a so-called booking die is used which allows the easy insertion of cores or the addition of other pattern components.

As is the case with other casting methods, due allowance must be made for shrinkage of the cast metal as well as any size changes that may occur in the size of the mold due either to the freezing of the mercury or to thermal expansion of the mold when it is heated to casting temperatures.

For short runs where only a few pieces are involved, it is sometimes possible to use a die made of either hot or cold rolled steel. Where longer runs are to be made, or when the die must be saved for later use, a good grade of tool steel is preferred for all of the die components.

Liquid mercury instead of molten wax or plastic

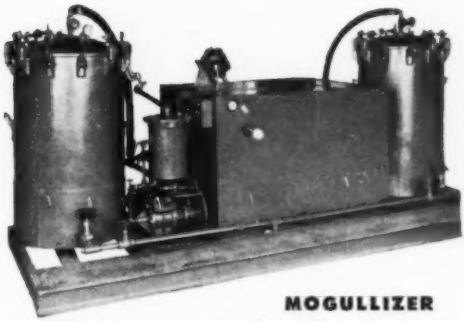
Given an adequate die, the caster is ready to start making the pattern around which the investment will eventually be made. It is in this step that the major departure of the Mercast process is made from the more conventional lost wax process.

The die or dies, as the case may be, are filled with mercury at room temperature. A sufficient head of mercury must be provided so that as the assembly is cooled, there will be an adequate amount of liquid to feed the pattern and compensate for shrinkage due to thermal contraction of the mercury.

Cooling is accomplished by immersing the die and the mercury filling in a bath of acetone at a temperature of from -85 to -135 F. Cooling of the acetone is generally accomplished with dry ice. This step is where the Mercast process shows one of the greatest improvements over other investment casting methods. Due to the high hydrostatic head of the liquid mercury and the ability of mercury to wet most clean surfaces, the liquid penetrates into every cranny of the die, thus giving faithful reproduction.

In this same step of freezing the pattern, the sharp freezing point of mercury is another advantage. All other pattern materials are complex mixtures which have a "melting range." Over this melting range, the pattern material is a slushy, semi-solid which draws away from the die walls. Since the liquid head is not great, there is no tendency for the still liquid material to hold the hardening wax tightly against the die walls.

With mercury, on the other hand,



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Illustrations are from unretouched photos.

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American Safety Razor's new Feather Weight Gem Razor weighing only 1 1/10 oz.

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If obtaining really small parts speedily and economically is your problem, too, why not let GRC tackle it? Gries' revolutionary, high speed, mass production methods are geared to turn out simple or intricate parts in one operation. Trimmed, ready for use . . . GRC zinc die castings as small as .000004 of a lb. in lots from 100,000 to millions . . . at a price to help you produce at a profit! Remember . . . it's GRC for *smallness unlimited.*

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the entire mass remains liquid and pressed tightly against the die walls. When the freezing point of the mercury is reached (minus 40 F.) the pattern solidifies. Freezing starts, of course, at the die walls where the mercury is the coldest. The completely liquid material in back of this initially frozen metal acts not only to fill the die, but also to keep the solid shell pressed tightly against the die walls.

When the entire pattern has solidified, it can be removed by opening the die and lifting the pattern out.

In many cases, it is not possible to make a die to fashion a mercury pattern in one piece. The investment caster, therefore, makes several dies so designed that the various pattern pieces can be fitted together to form the desired final shape to be cast. This involves making cores as well as pattern pieces that give the desired outside configuration.

When these various pattern parts are all made, they can be assembled

DIE CASTINGS

ALUMINUM OR ZINC

☆

C.M. GREY MFG. CO.

QUALITY PRODUCTS SINCE 1910

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by welding. In this case, welding takes place at a temperature below the freezing point of the mercury. Each component is put in place and a very slight amount of pressure exerted by hand. The slight pressure exerted is sufficient to cause welding of the two mercury surfaces.

The pressure welding takes place by virtue of the lowering of the melting point of the mercury under pressure and the formation of a very thin film of liquid on the pressure surface. When the pressure is released, the mercury is immediately frozen again. Most engineers will remember the classical demonstration in physics of a wire cutting its way through a cake of ice due to pressure being applied on the wire and the subsequent instantaneous freezing of the water in back of the wire leaving no trace of where the ice was melted to allow the wire to progress through it.

Fine grained ceramic yields smooth surface on casting

After the frozen mercury pattern is completed and an adequate gate in-

DISCRIMINATING BUYERS HAVE SELECTED

STROH
SINCE 1903
FOR SERVICE

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Metals? ⇨ Contact Belmont — All Metals, All Alloys, All Forms — and SERVICE!

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with ZAMAK (ZINC BASE)
DIE CASTING ALLOYS

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We're doing everything we can to take care of the needs of our customers—old and new. The name HENNING has stood for absolute satisfaction for many years.

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HB&S HB&S HB&S HB&S

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stalled for pouring, it is ready for investing.

Investing is the art of applying a ceramic coating to the pattern of a material which will bond together sufficiently so that when the pattern is removed a shell of ceramic will remain into which molten metal can be poured.

In the Mercast process the pattern is dipped into a slurry of ceramic suspended in a non-aqueous solvent that evaporates rapidly even at the low temperatures employed. The first dip coat is extremely fine grained so as to secure faithful surface reproduction. Subsequent dips are in coarser grained material. The dipping is continued until an investment is built up about one quarter of an inch thick. By its nature, the investment is porous so that in later steps there is less tendency for entrapped gases when metal is poured.

Removal of the mercury pattern from the finished investment is easy. A stream of mercury at room temperature is directed against the frozen mercury to start the thawing. Thereafter, the process is self perpetuating until all of the mercury has melted and run out of the mold.

In this step, the high density and high surface tension of the mercury again are an advantage. As melting proceeds, drainage of the mold is very complete. The high surface tension draws the liquid from even the smallest holes and crevices in the investment and high density causes the liquid to run on the slightest slopes.

After the mold has been completely drained, it is fired at approximately 1850 F for from one to two hours to set the ceramic.

After firing, the ceramic investment is a strong though porous mold into which molten metal can be poured. The surfaces which come in contact with the metal are smooth and fine grained so as to give an unusually good finish in the as-cast condition. Die detail is reproduced with almost photographic accuracy and the combination of a mercury pattern and a porous investment preclude the possibility of a blown casting due to entrapped gases.

As a rule, the investment is backed with sand as an added precaution against mold fracture and the molten metal cast while the mold is still hot.

Pouring temperature depends on the metal being cast and section thicknesses of the casting.

Both gravity poured and centrifugal casting is practiced with the preponderance of parts being cast centrifugally. In either case sound castings are uniformly produced.

Almost any castable metal can be used in the investment casting process, ranging from the low temperature metals such as zinc and magnesium through the ferrous alloys, including the special high temperature cobalt base alloys and the stainless steels.

The range of end product shapes is multiplied because of the wide range of mold preheating which may be had. For example, for one product cast of a high temperature alloy and designed with long thin sections, the ceramic mold is preheated to about 2100F and the metal is poured at about 3100F. Experimentally, a preheated mold was successfully cast with a chromium-rich alloy at a pouring temperature of approximately 3400F.

Most other investment casting processes are limited rather sharply in the size of parts that can be cast. From less than one ounce the castings run up to a few pounds depending on the metal being cast. The Mercast process, however, has stretched the upper size limit very considerably and castings of stainless steel weighing 125 pounds have been made. Such large castings are still rare, but castings weighing as much as 90 pounds are often produced.

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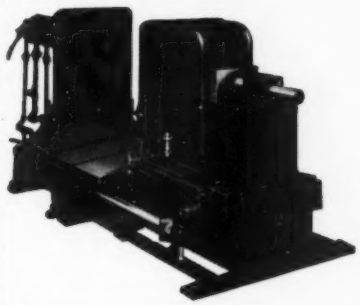

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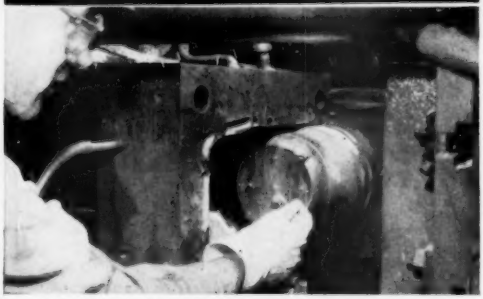
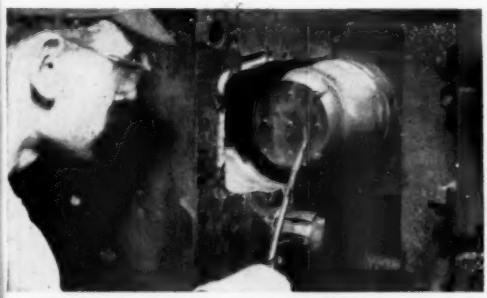


FOR BRUSHING OR SPRAYING on dies casting zinc or aluminum—specify Mouldlubric 306. A paste-type lubricant containing "silvery" pigment, equally effective when brushed on "neat" or diluted for spraying.



IDEAL FOR SPRAYING on dies used for either aluminum or zinc castings is Mouldlubric 306L. This fluid-type lubricant has a viscosity around 110 seconds at 210° F.—a flash point of 480° F.

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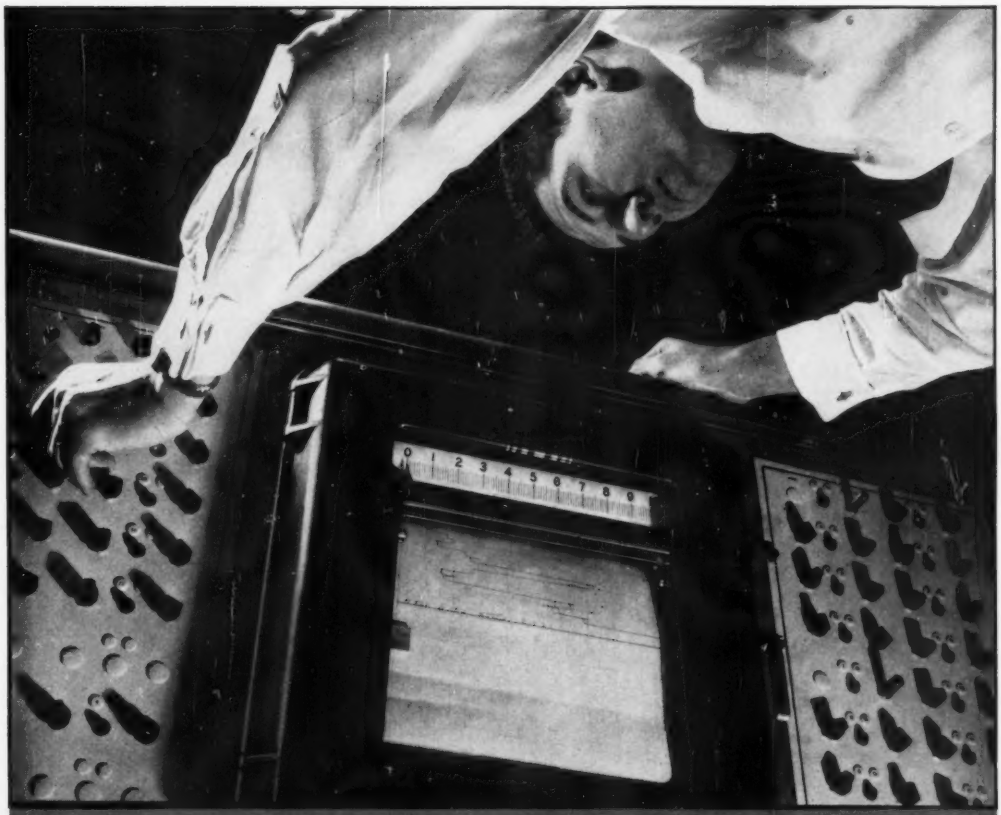

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